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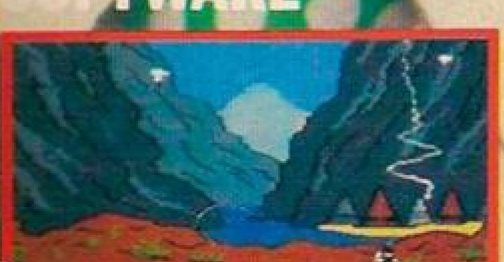


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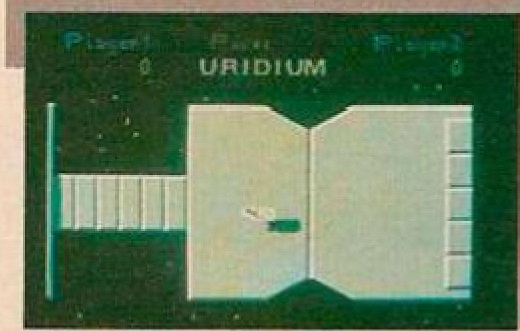
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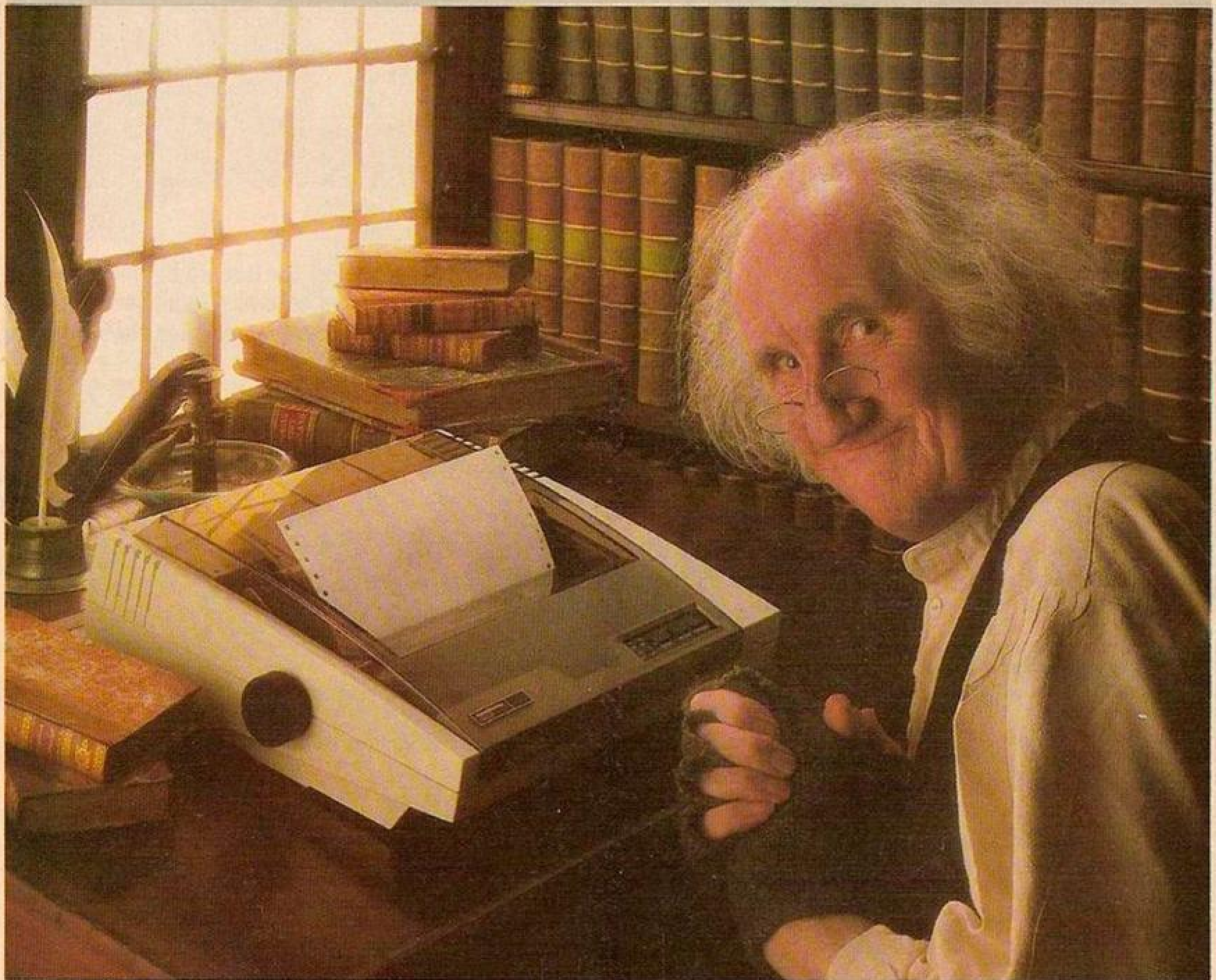








Thrifty micro owners choose the new MT80+



Keen on saving money? But not prepared to sacrifice quality and performance? Then the new MT80+ serial matrix printer has plenty to offer at a price that will have you rubbing your hands with glee.

The MT80+ prints at 100 cps and is compatible with just about any popular office or home micro. For true print flexibility, there's compressed and expanded print, subscripts and superscripts, bold print, italics and, of course, graphics.

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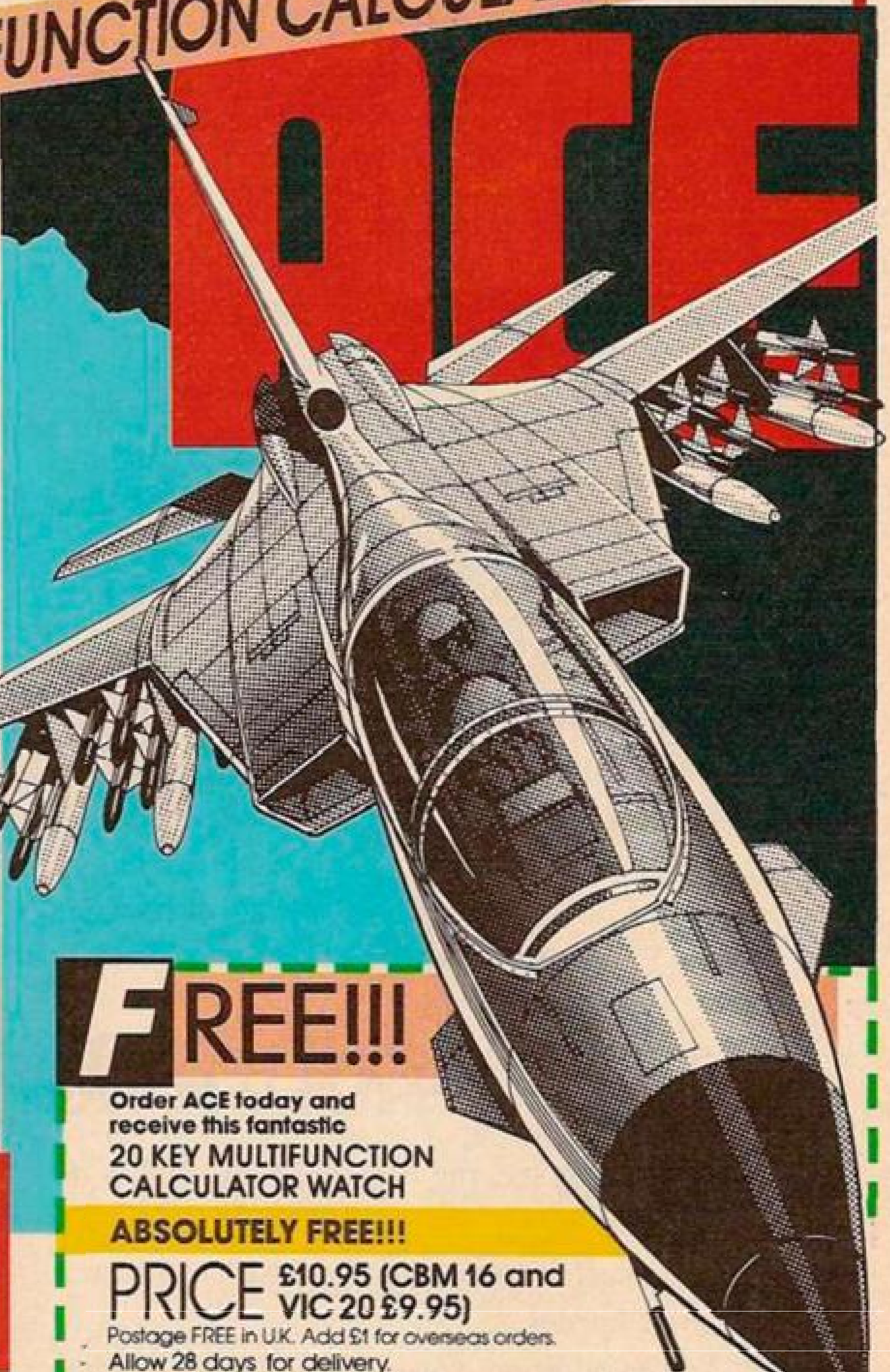
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- **Synchro Speech** © ie. the speech does not freeze the action.
- Two seat option – fly and fight with the aid of a friend.
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- AWAT © operation (All Weather All Terrain).

* Note due to memory limitations ACE on the C16 and VIC20 (+8K Ram) do not have any ground objects.

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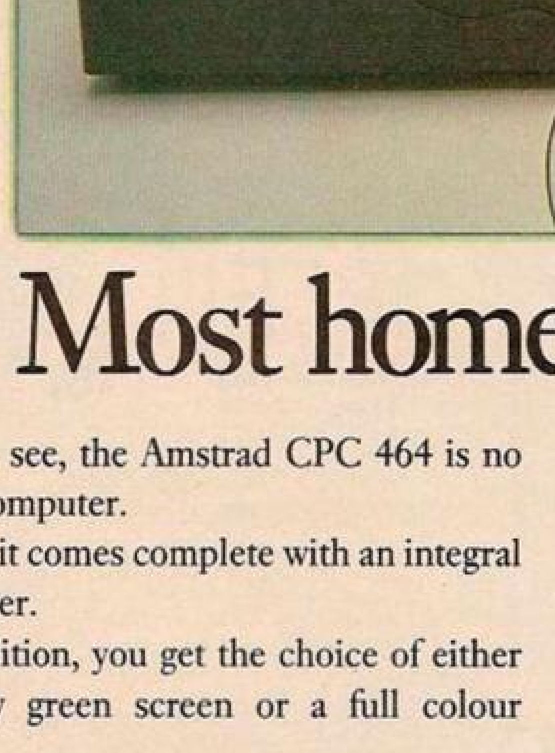
As you can see, the Amstrad CPC 464 is no ordinary home computer.

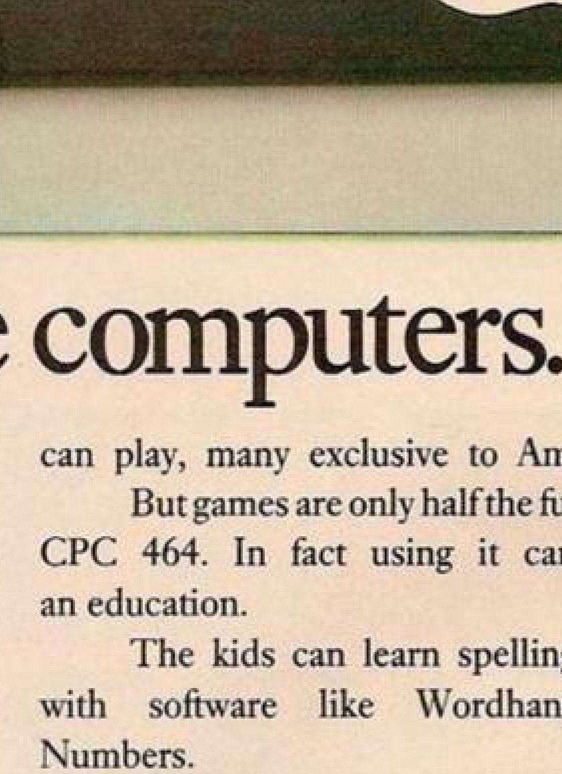
For a start, it comes complete with an integral cassette datacorder.

And in addition, you get the choice of either a superb quality green screen or a full colour monitor.

With £100 of free software to get you going all you have to do is plug in and start computing.

The 64k of RAM means you'll have plenty of memory to play with. And there are over 200 Amsoft games, that you can play, many exclusive to Amstrad.





But games are only half the fun on the Amstrad CPC 464. In fact using it can also be quite an education.

The kids can learn spelling and arithmetic with software like Wordhang and Happy Numbers.

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Put the 464 to work and it will take care of a number of business-like functions, such as wordprocessing and spreadsheet.

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To help you get the most from your CPC 464, there's the Amstrad User Club as well as a number of books and user magazines devoted to this most versatile home computer.

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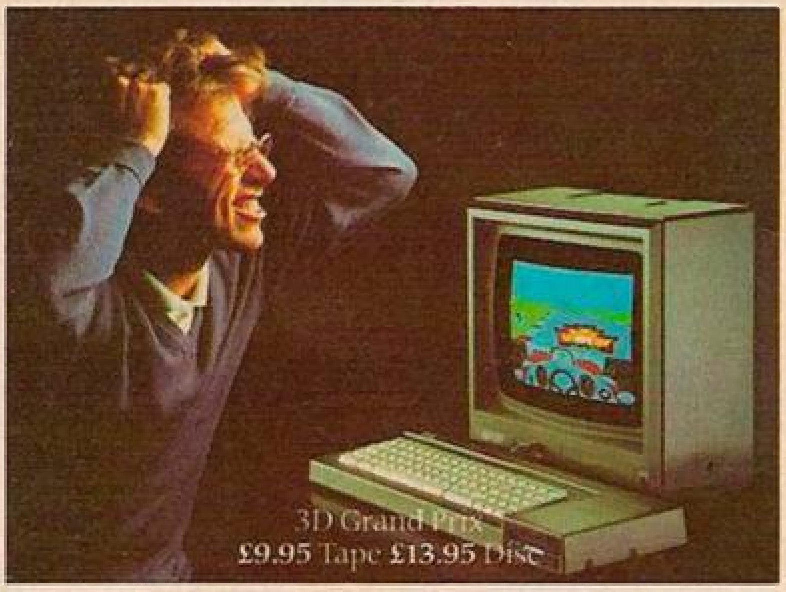
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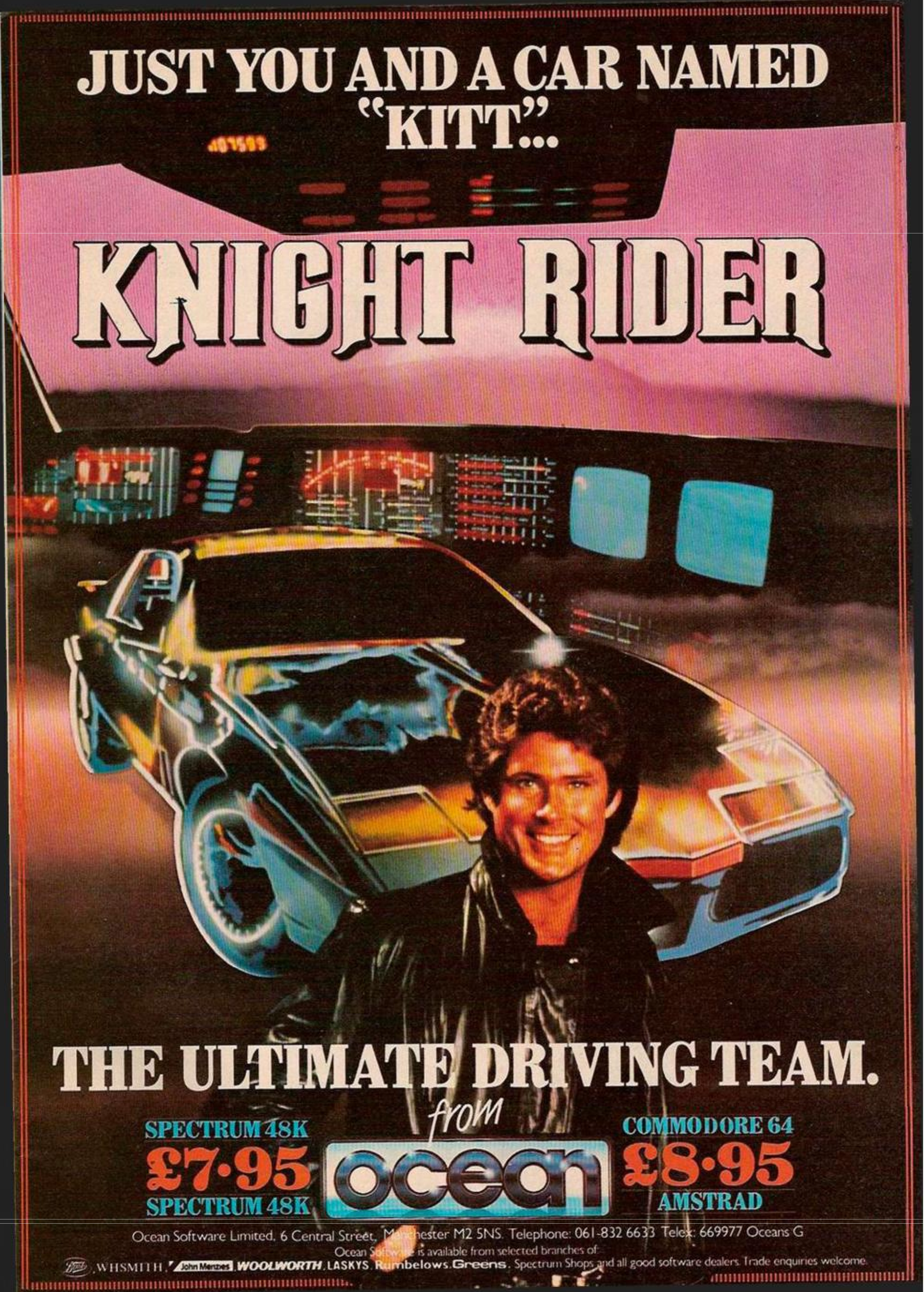


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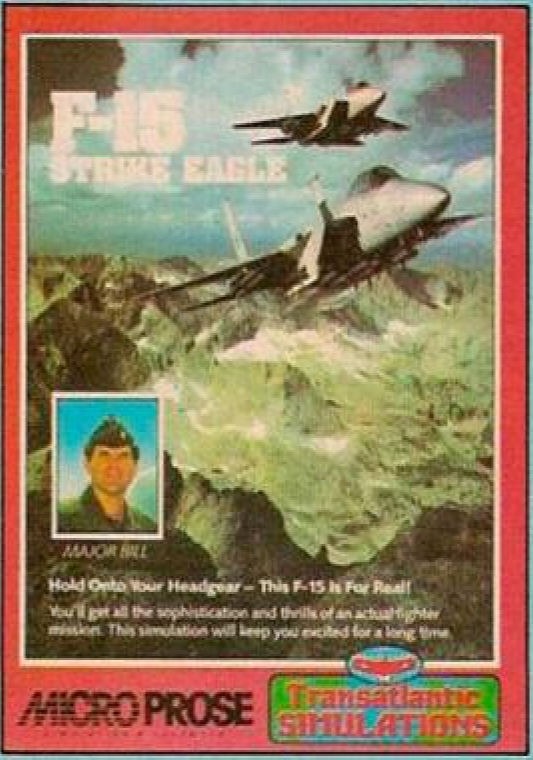
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Feature	"Real" F-15	F-15 Strike Eagle
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• Cannon	Yes	Yes
• MK-82 Bombs	Yes	Yes
• Air-Air Missiles	Yes	Yes
2. Sophisticated Electronics		
• Heads Up Display	Yes	Yes
• Radar	Yes	Yes
• Electronic Counter Measures	Yes	Yes
• Inertial Navigation	Yes	Yes
3. Real Combat Missions	Yes	Yes
4. Developed and tested by Real Fighter Pilots	Yes	Yes
5. Aerobatic Flying (Loops, Splits and Yo Yos)	Yes	Yes

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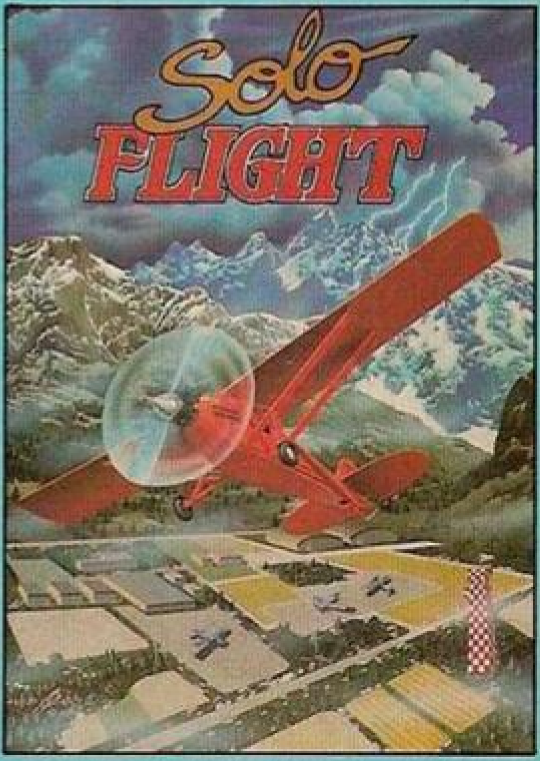


NATO-COMMANDER

Pin on the four stars of a Nato General and defend Europe in a heart pounding, accelerated Real-Time war simulation! React to the combat radio, teletype, and news service messages from the battle front, and use your full continent scrolling battle map to deploy, manoeuvre, and command the battle units, including infantry, armour, helicopters, air forces, and tactical nuclear weapons in real time to stop the ever advancing Warsaw Pact battle units! Nato Commander is great fun and challenge for wargamers and arcaders alike!

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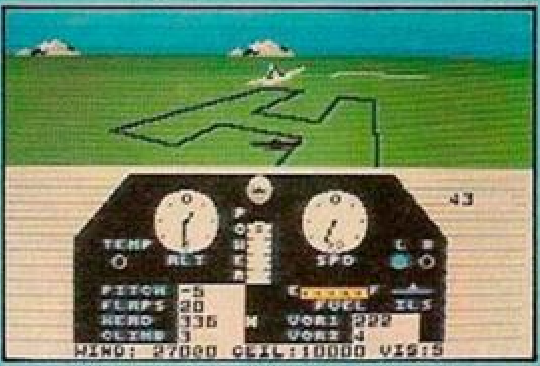




SOLO FLIGHT

Solo Flight is an outstanding flight simulator that will provide you with the thrill, excitement, and joy of flying your own aircraft. Solo Flight uses superior three dimensional graphics to provide realistic take-offs, landings, and cross country navigation under both visual and instrument flight rules among 21 different airports, in three different geographical areas of the United States. Options include touch and go's, visual or instrument flying, full cockpit instrumentation, dual VOR navigation radios, an instrument landing system (ILS), multiple air navigation maps, four difficulty levels, and emergency procedure practice. In the game mode the player uses his superior skills to deliver the U.S. Mail quickly and safely among the various airfields. This simulation is a realistic trainer and outstanding fun for all ages!

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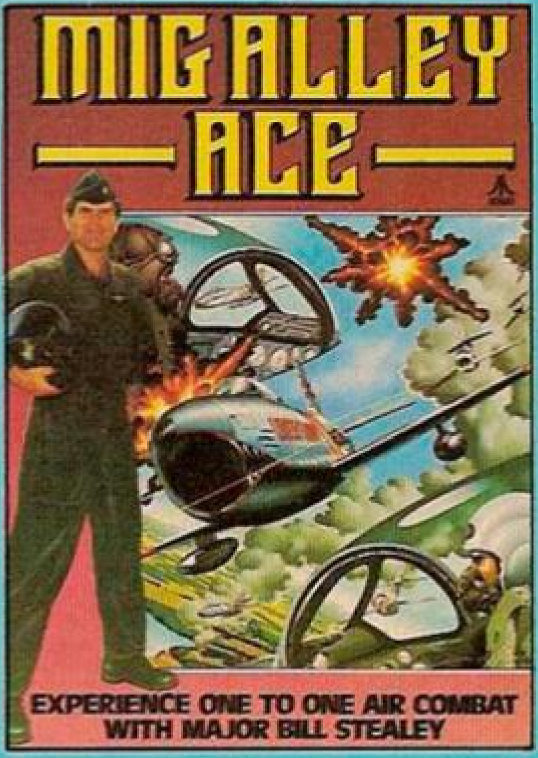


SPITFIRE ACE

Strap on your parachute and man your fighter!! Save London during the Blitz in your Supermarine Spitfire!! Fly loops, Immelmanns, and all the real air-to-air combat manoeuvres using outstanding, out of the cockpit 3-D graphics!! SPITFIRE ACE (European Theatre) provides at least 9 different Combat scenarios and fast paced action that puts you right on the edge of the real personal danger of being shot out of the sky!! For 1-4 players!!

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MIG ALLEY ACE

MIG Alley Ace is an exciting and action packed split screen head-to-head aerial combat flying simulation. The game allows two players to fly against each other in their own jet fighter and each receive outstanding graphics and flight information as if they were in the cockpit of their own F-86 Sabre Jet. The game play consists of a series of actual fighter pilot manoeuvres, from loops and High-G turns to Hi-Yo-Yo's, as each player attempts to centre his opponent's aircraft in his gun sights and shoot him down. Additional game options include a solo mode against one to three enemy aircraft, and a co-operative mode where two human players can fly against two computer controlled enemy aircraft. Five actual Korean War scenarios are included, each with five different skill levels. MIG Alley Ace is an outstanding simulation that requires superior fighter pilot skills and guts to survive and win the Silver Wings of a Jet Ace!

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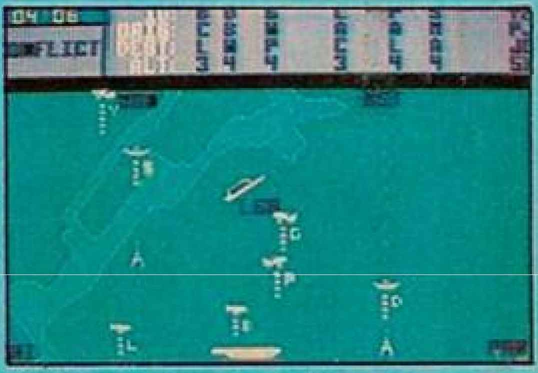


KENNEDY APPROACH

You will hear both their radio calls and your broadcast messages in high-quality speech. All commands can be given using the joystick. This simulation is immediately playable and enjoyable. The safety of hundreds of passengers is in your hands as you guide jet airliners, private planes, and even the supersonic "Concorde" to and from their destinations.

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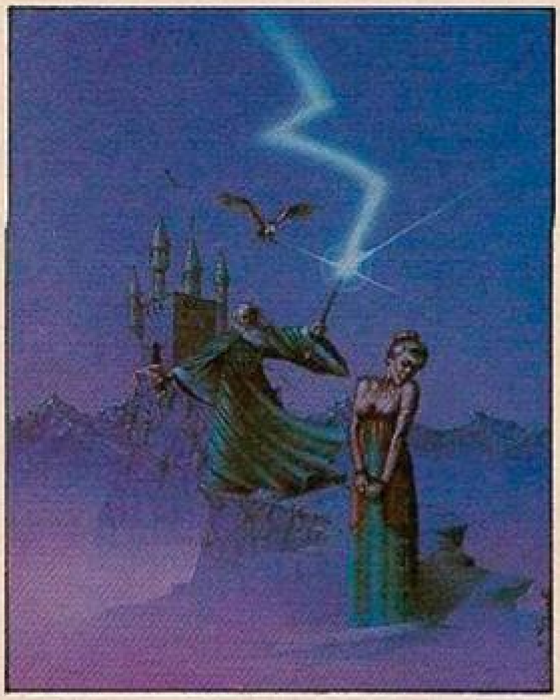
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VENTURE IN T

Enter the world of computer adventure. Each adventure takes several weeks to master, providing hours of fascination and intrigue. You must use your imagination and logic to unlock the mysteries of each adventure.
Map skills are essential; each adventure contains full-colour computer generated images which lead you in every direction. You'll need to muster up all your wit and logic and perseverance for each of our adventures will prove a test to your imagination and ingenuity.

The Wizard & The Princess
from Sierra On-Line

Become the hearty and steadfast adventurer who rescues the fair princess from the dreadful wizard, Harlin. He has taken her to his towering castle beyond the great mountains. You must outwit and outmanoeuvre the mystical power of the wizard which has grown dark and potent through time. Begin your adventure in the village of Serinia, but take heed, everything is not as it may appear.



Exodus-Ultima III
from Origin Systems

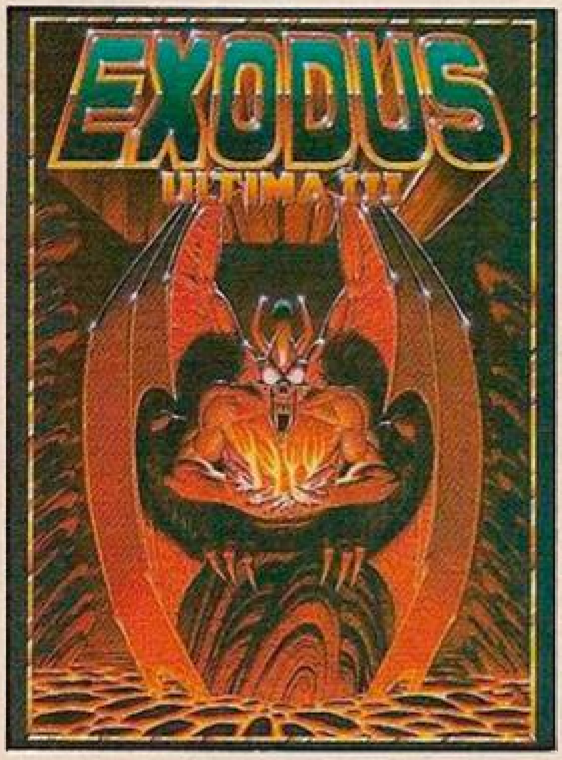
Upon escaping the crumbling ruins of Shadowguard, the black fortress of Minax, you lay your weary body on the now-sacred ground. As you rest, you remember your first encounter with the evil wizard of Mondain, whom you later tracked down and destroyed. The existence of his apprentice, Minax, was soon revealed and the crusade was begun again. Younger and more cunning than her mentor, she has been much more difficult to vanquish. But now your sense of accomplishment is touched by a chilling fear. Have all vestiges of evil been removed? Somehow, you sense that your trecherous foes have not been eliminated. Without further feats of skill, daring, and perseverance, all of your past accomplishments may be lost. You stand up, prepare your armour, and walk to the dimension door. Stepping in, the hunt resumes.

An Epic Fantasy Role-Playing Experience

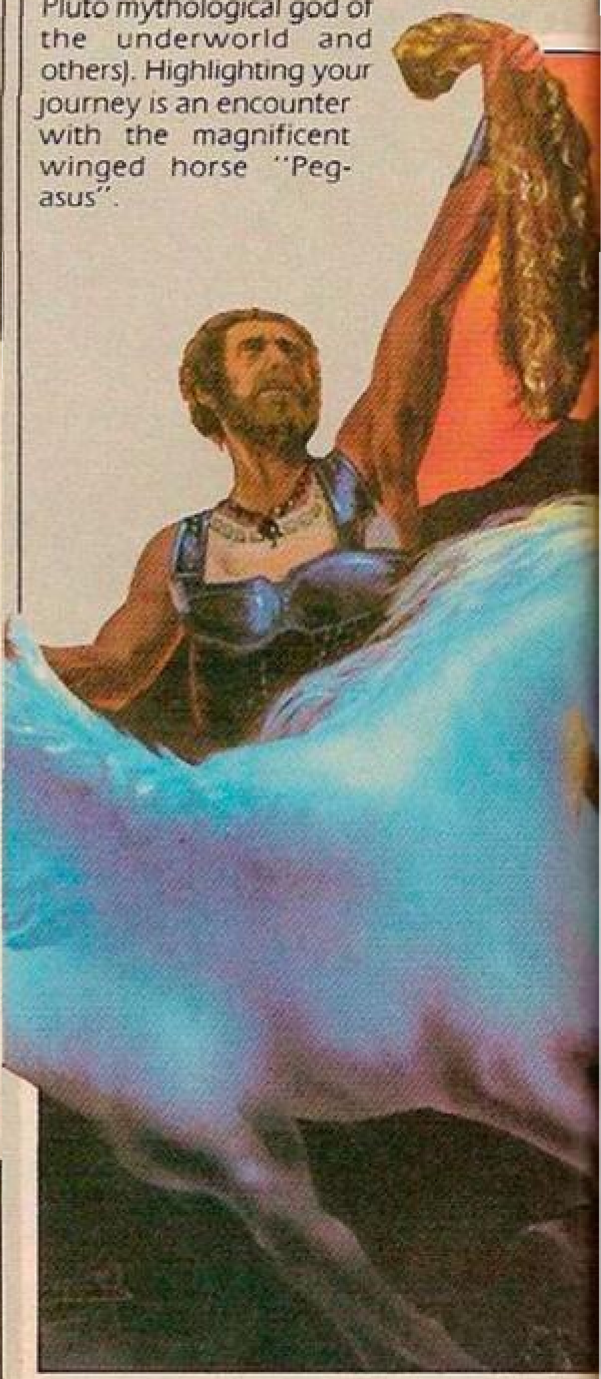
- Up to 20 character roster
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- *New astrological influences*

Ulysses & The Golden Fleece
from Sierra On-Line

Protected by the gods, the "Golden Fleece", legendary treasure of ancient mythology, has been kept from man for many decades. Many valiant men have attempted its recovery, but none have been successful in possessing it for any amount of time. The setting is ancient Greece and YOU are Ulysses. The king has requested an audience with you, to assign you the task of retrieving the "Golden Fleece", and returning it safely to him.
On your voyages you will encounter many of the same foes dealt with by your predecessors. (The wicked "Sirens", whose beautiful songs lure unsuspecting seamen to their deaths on the island's trecherous shores: the Cyclops, son of king Neptune; Pluto mythological god of the underworld and others). Highlighting your journey is an encounter with the magnificent winged horse "Pegasus".



Wizard & The Princess	C64 Disk	**£14.95**
Exodus-Ultima III	C64/Atari Disk	**£19.95**
Ulysses	C64 Disk	**£14.95**



M UP SPACE INVADERS?
s time to
TO THE UNKNOWN

Legend acclaims Ulysses as the most daring and skilled seaman of all time. Clad in a pocketed "toga" and chain armour, it's up to you to prove it!

Mission Asteroid
from Sierra On-Line

A terrible tragedy is about to happen... An asteroid of incredible size is headed for a direct collision with the Earth. The predicted impact could destroy all life here — unless something is done quickly.
As an astronaut, it's your duty to rocket to the asteroid and attempt to alter its course.

There's no time to lose! If you don't do things exactly right and travel fast enough, there will be DISASTER!
The asteroid will collide with Earth at a pre-determined time. You are wearing a watch, which, if checked periodically, will let you know how much time you have left.
If you're quick and careful, you will save us all from oblivion. If not, don't bother landing on Earth again, you will have no home to return to... Good luck!

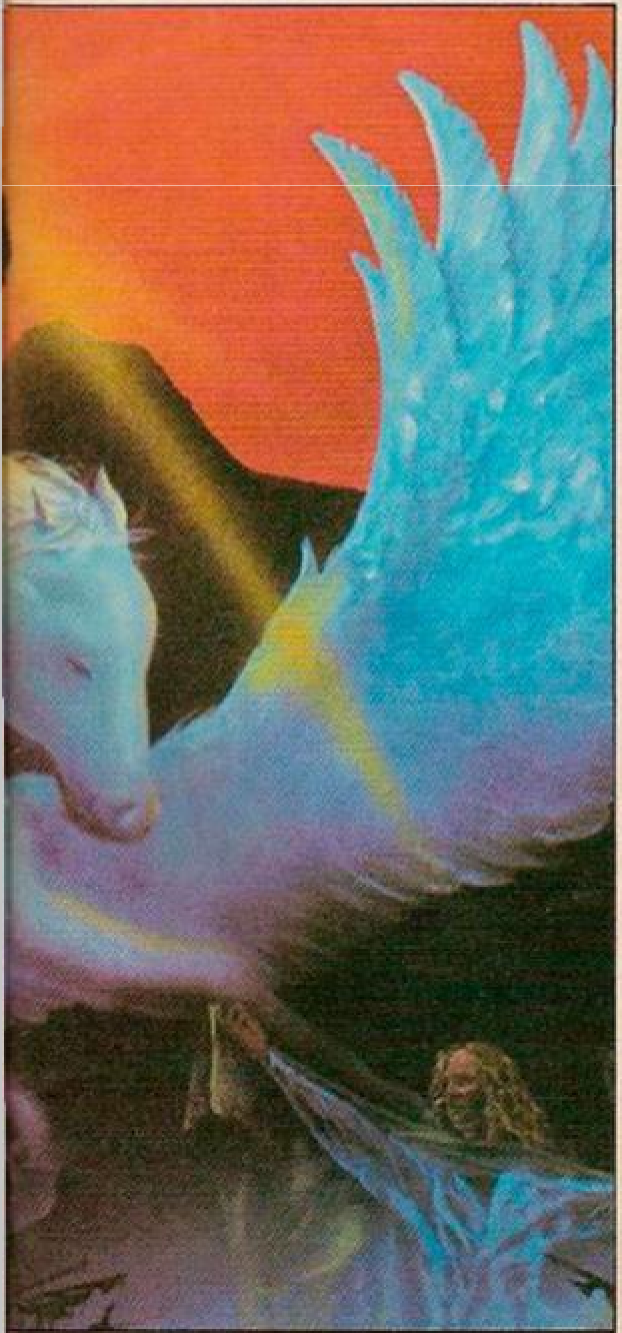
Lucifer's Realm
from American Eagle

By some tragic twist of fate your departure from this life leads not to Heaven as expected, but a journey which deposits you in Hell!
On coming face to face with Lucifer you find he is strangely kind to you. A path to Heaven can be yours but tread carefully — this journey is littered with the likes of Adolf Hitler and Benito Mussolini.

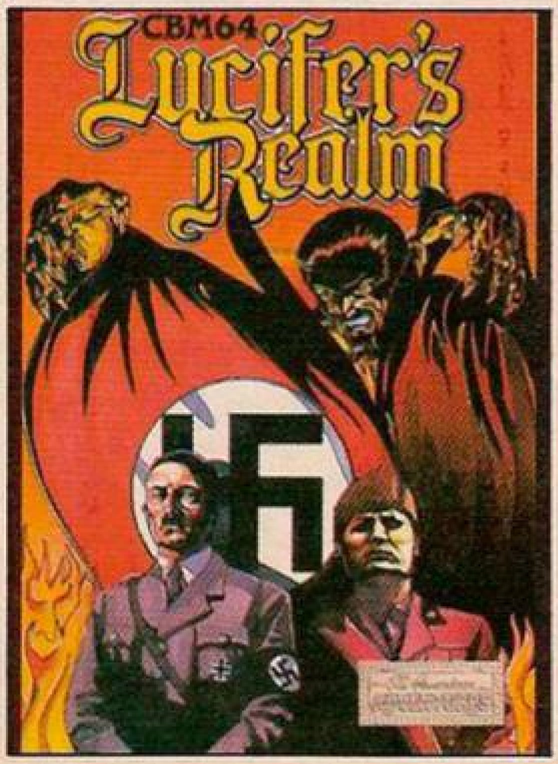
Masquerade
from American Eagle

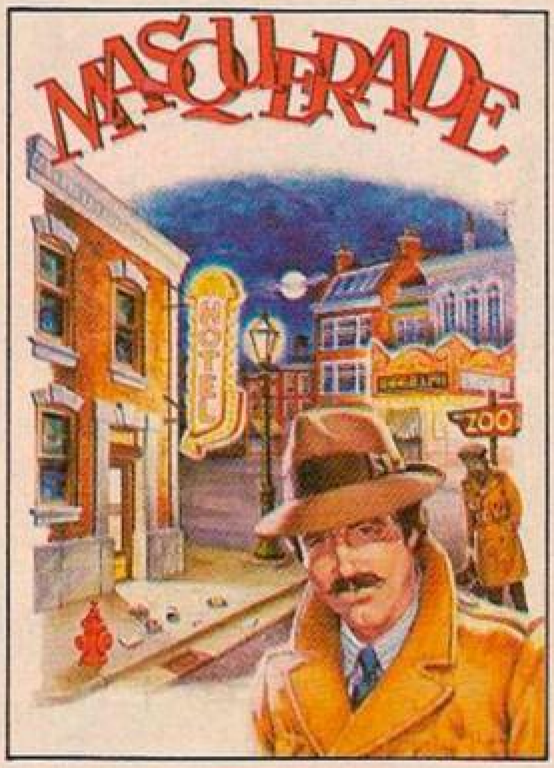
It turned out to be the toughest case of your detective career. Clues have led to nothing but dead ends. Nobody is talking. Meanwhile, the crime boss you are after is still operating from somewhere. You're about to throw in the towel. But wait! Something breaks. You trail a stooge of the crime organisation to a cheap, seedy hotel, hoping to pump some answers out of him. You break into the hotel room and with the butt end of your trusty .44 magnum, you knock him cold. This could be the lead you've waited for. Maybe, just maybe, if you could find some clues...

Mission Asteroid	C64 Disk	**£14.95**
Lucifer's Realm	C64/Atari Disk	**£14.95**
Masquerade	C64 Disk	**£14.95**





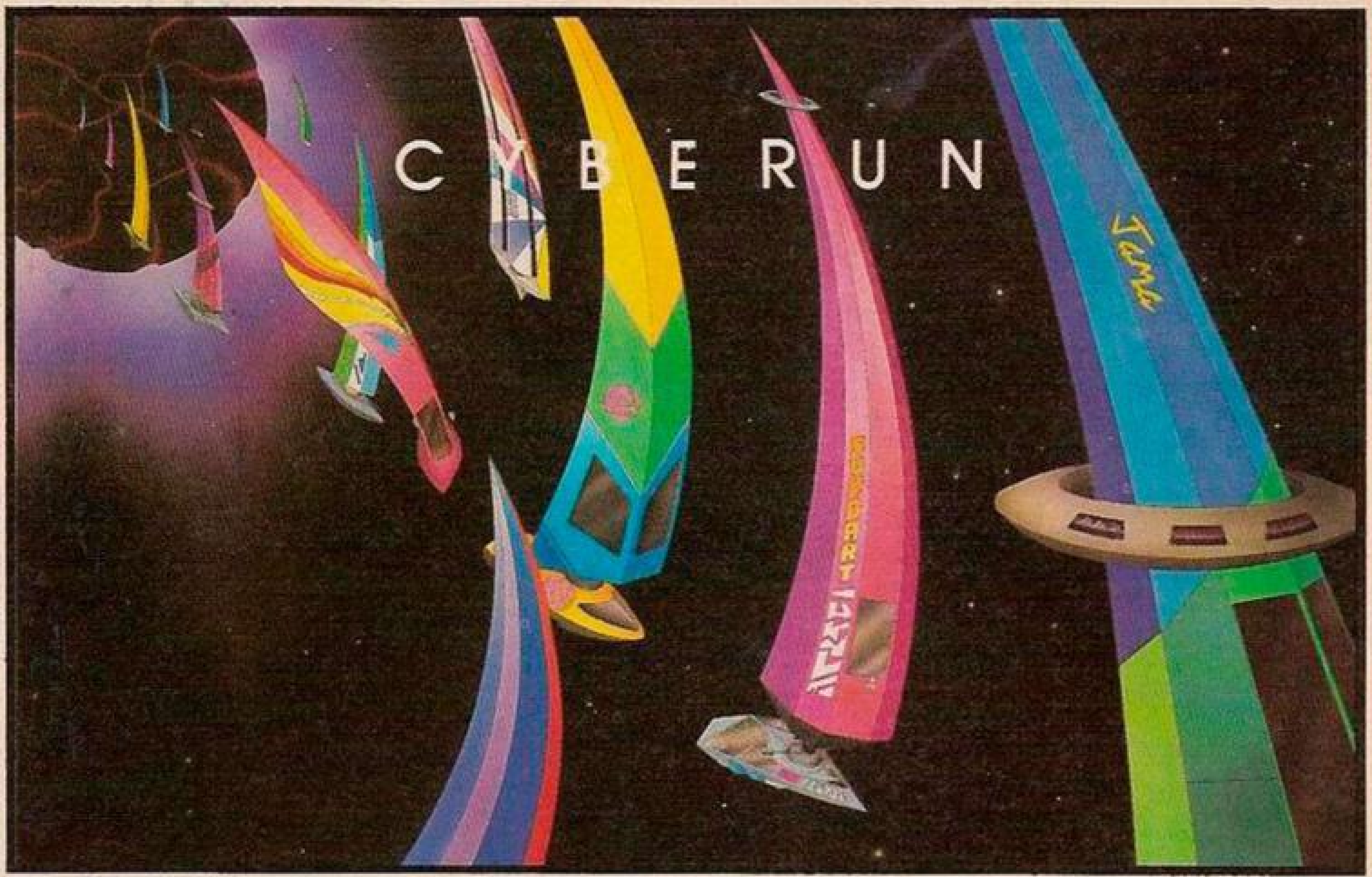


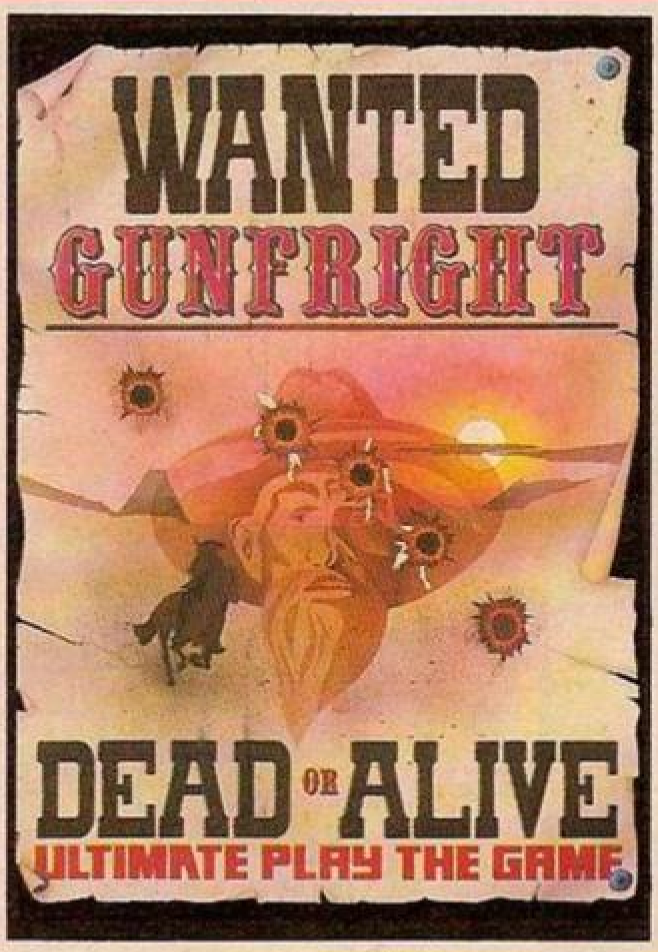


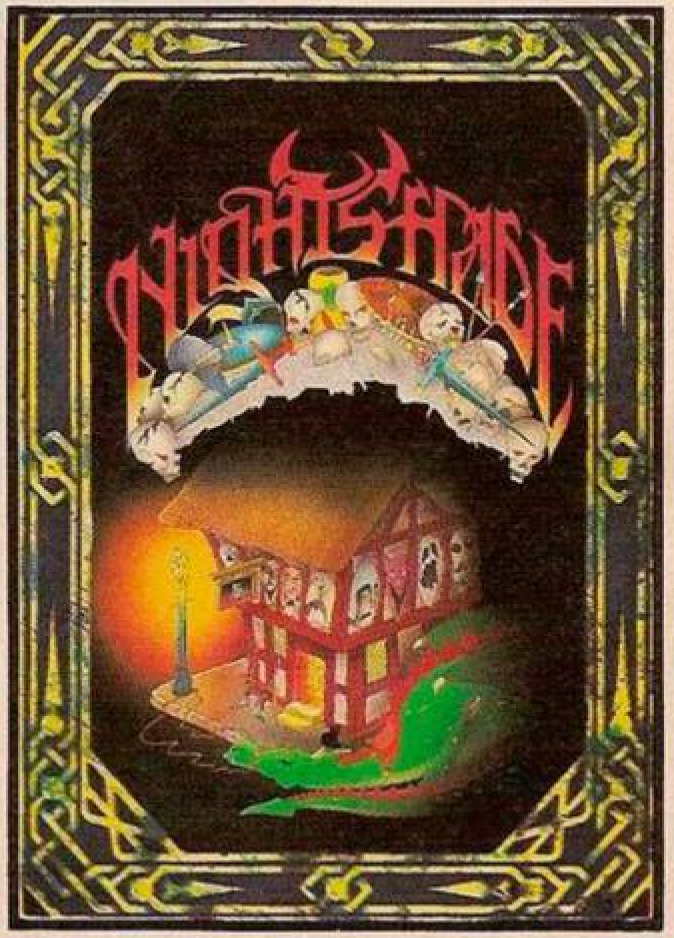
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AMSTRAD CPC 464







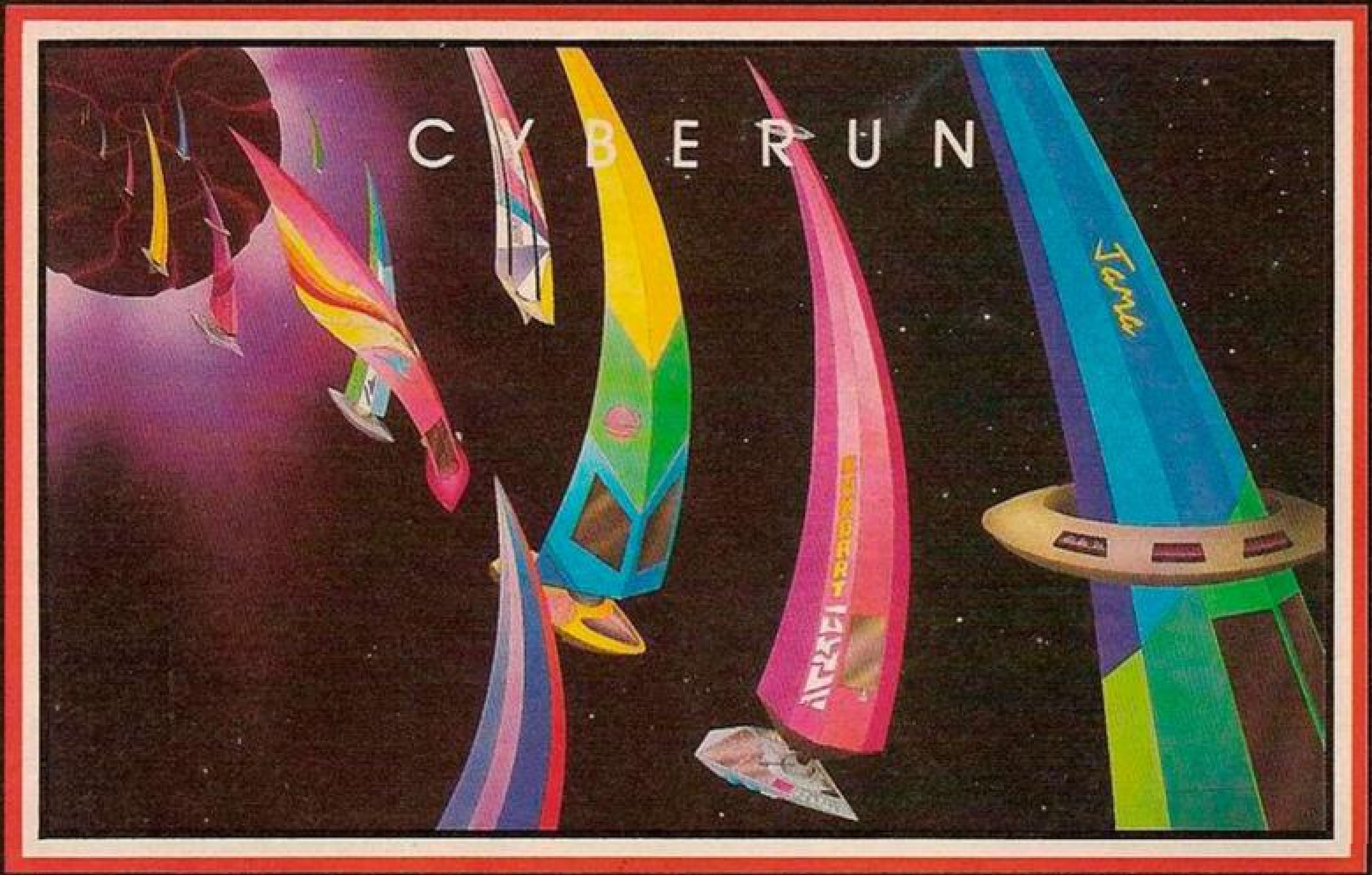
"CYBERUN", "GUNFRIGHT", "NIGHTSHADE" recommended retail price £9.95 inc VAT.
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and all good software retail outlets. Also available from
ULTIMATE PLAY THE GAME, The Green, Ashby-de-la-Zouch, Leicestershire LE6 5JU
(P&P are included) Tel: 0530 411485

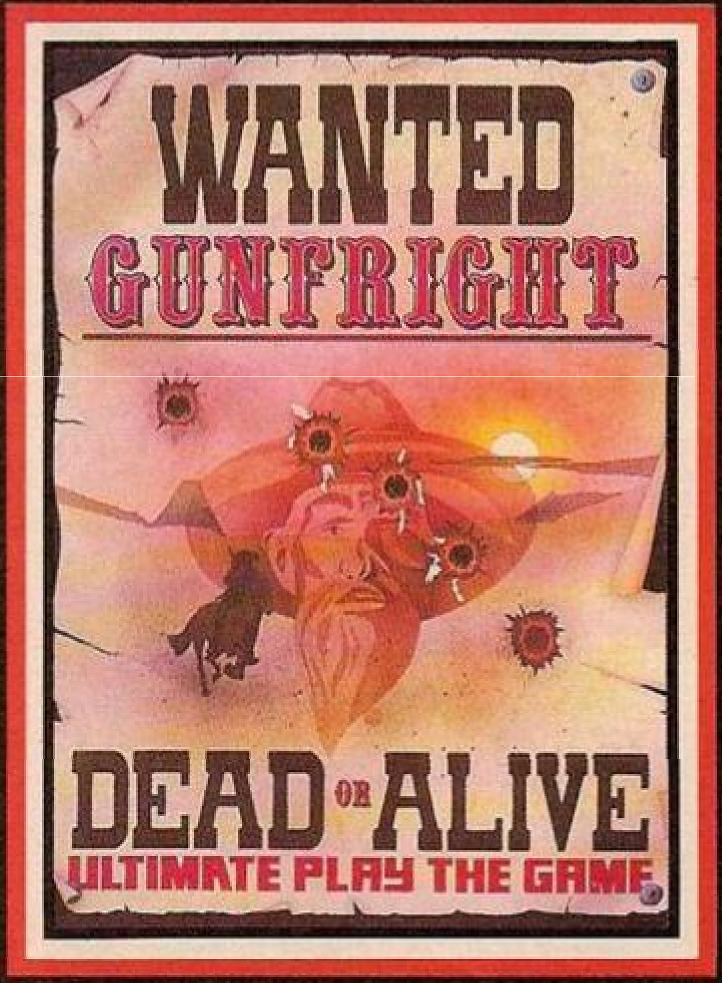
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Blue print (part) supplied. Ky-Al-Nargath construction. ≅ MEGA SECURE !!! Madrag [genetically boosted saurian] + psycho
all times. ≷ Halt Heatonite prod. ▶ Access via VDU. Programme concealed in game Pack ☐ Who would think of a Police box?
2nd Moon Rijar.
Zl (Ur₄ (Ā¹³C₅H₅N)₈ O₄ Fl₈) OH₄ · 16H₂O
Use invisible cat + code: string ◇ etc. Full cerebral combat status needed
ARE YOU READY FOR BRAIN TO BRAIN COMBAT
DOCTOR WHO AND THE MINES OF TERROR
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IN ASSOCIATION WITH THE BBC
– robotics + techno trickery ≡ Force futile. ▼ Weapon Skills NA ▼
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ULTIMATE PLAY THE GAME

DOCTOR WHO AND THE MINES OF TERROR IS AVAILABLE AT THE FOLLOWING OUTLETS:

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Alton Computers, 62 High Street, 0420 87998

BANSTEAD
Computerama, 17 Nork Way, 07373 54717

BOURNEMOUTH
Lansdown Computer Centre, 1 Landsdown Crescent, 0202 290165

BRIGHTON
The Gamer, 71 East Street, 0273 728681

BROMLEY
The Data Store (Micro Computers), 6 Chatterton Road, 01 460 8991

BRISTOL
The Model Shop, 64 Fairfax Street, 0272 27344

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Heffers Booksellers, 19 Sydney St., 0223 358241

CHALFONT ST. PETER
Softshop Limited, 55 St. Peter's Court, 0753 889010

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Q.E.S. Computers, 60 Stockport Road, 061 428 6912

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Computer Shack, 14 Pitville Street, 0242 584343

CHICHESTER
Computermania, Southgate, 0243 779263

DORCHESTER
Seven Counties, 20 High East Street, 0305 66022

EXETER
Seven Counties, 7 Paris Street, 0392 211211

FAREHAM
Timatic Systems, Fareham Market, 0329 236727

FAREHAM
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H Reynolds & Sons, 28A Southend Road, 0375 31641

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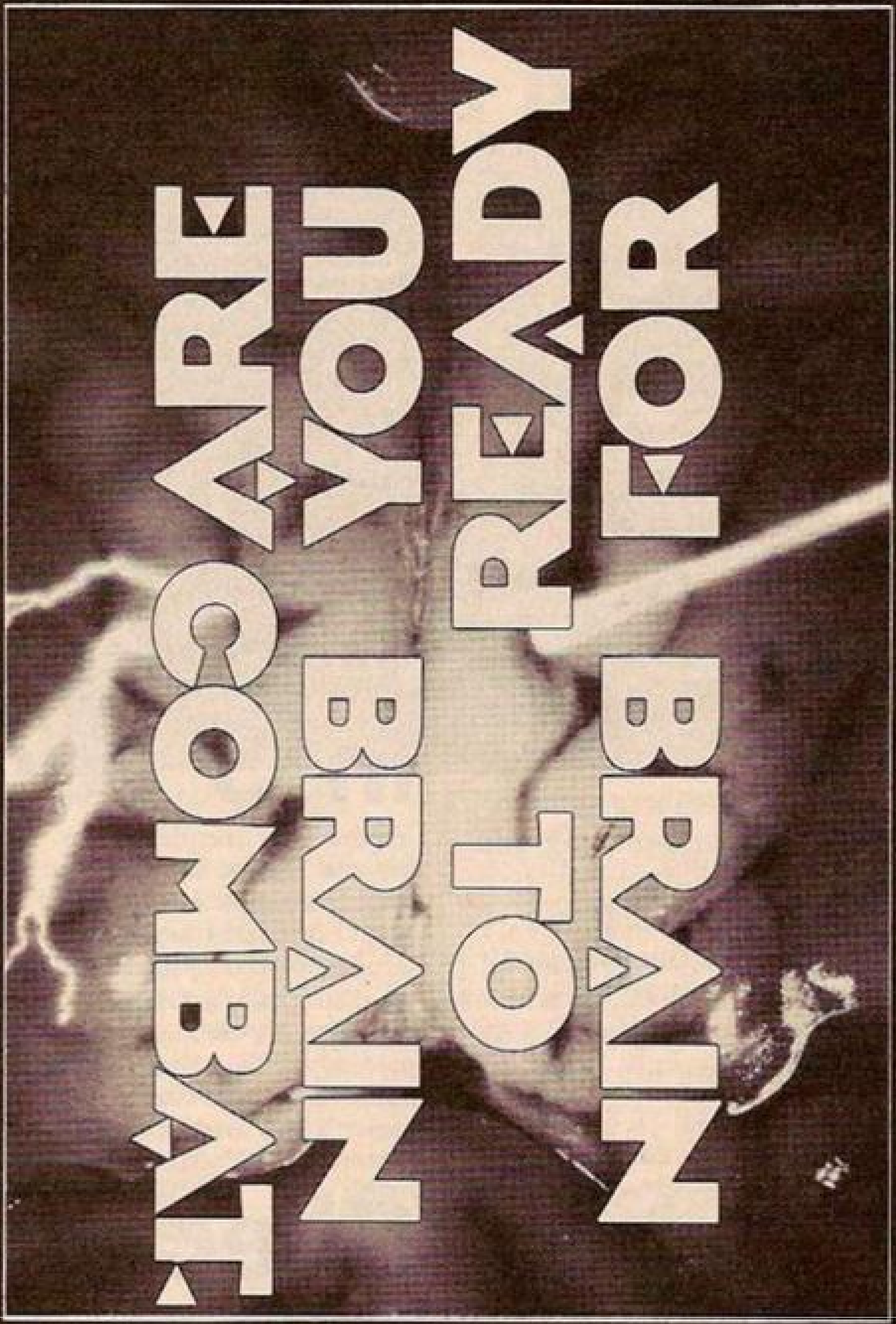
LONDON SE1
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DOCTOR WHO AND THE MINES OF TERROR WILL ALSO BE AVAILABLE AT MOST MAJOR HIGH STREET SHOPS

DOCTOR WHO AND THE MINES OF TERROR

MICROPOWER MicroPower Ltd., Northwood House, North Street, Leeds LS7 2AA

Edit...

GOOD TIMES, BAD TIMES

Don't believe what they tell you. The truth is that despite the disasters of 1985 computers and software have sold better than ever this Christmas.

It may be difficult to credit it after a year when Acorn twice had to hide behind Olivetti's Turin shroud to escape oblivion, and Sinclair and Commodore managed to clock up millions — in losses.

Clearly all that adds up to a lot more than just a bad attack of hiccups. But that isn't the whole picture. While most of the hardware manufacturers were gasping for cash, the survivors of the software industry were breathing new life into games.

Programs like Alien 8, with its superb graphics, Frankie goes to Hollywood, which brought icons and windows to home computing, and Way of the Exploding Fist, which did to animation what sound did to movies, all pushed game-playing and programming to new heights.

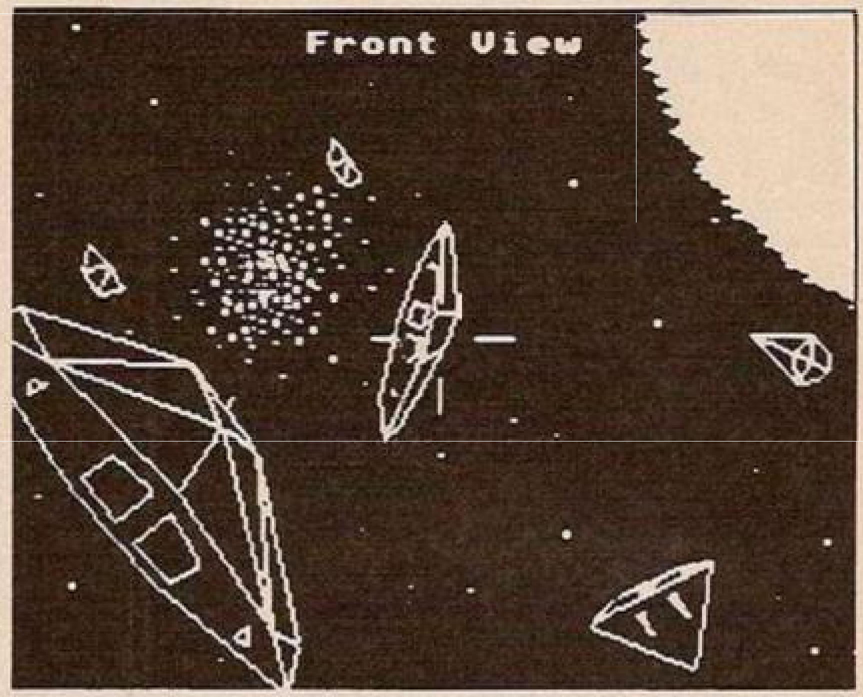
To be honest, even on the hardware side it wasn't catastrophes all the way. No one can deny that Amstrad, thanks to the 6128 and 8256, is now a major force in European computing. And Stateside, although the noises coming out of the Commodore make it sound as if they've sat on another financial whoopee cushion, Tramiel's STs are making people take Atari seriously again.

Let's try forgetting 1985 for a moment, and try a bit of guesswork about the future. When Sinclair decides to start pushing the Spectrum 128 in this country it will be the first time that the top-sellers from all the manufacturers will sport the same size memories. Think what that will do for the software houses.

The accent may shift away from eight-bit technology. As the Japanese regroup after the MSX rout, Western micro-makers will have to come up with something very special to beat them off for a second time. Let's hope it does come to a fight — it will stop the big boys from becoming too complacent. It may make them sweat but the exercise should do them good. And in the long run we'll be the winners.

Editor: TOBY WOLPE; **Software Editor:** SIMON BEESLEY; **Commercial Software Editor:** PAUL BOND; **Staff Writer:** LEE PADDON; Editorial 01-661 3144. **Advertisement Manager:** NICK RATNIEKS 01-661 3127; **Assistant Advertisement Manager:** KEN WALFORD 01-661 8548; **Northern Office:** CHRIS SHAW 061 872 8861; **Classified:** IAN FAUX 01-661 3036; **Publisher:** RICHARD HEASE. Your Computer, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

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Join the Elite in 3 seconds

Impress your friends, be the life and soul of the party. With this simple bug, you can reach Elite status in three seconds. Step one, load the tape; step two, get through the hideously complex Lenslok procedure (OK we were lying about the three seconds). Now press "Y" to load new commander. When on the save/load screen press "2" to save, press return when it asks for a name. After saving press "3" to exit and — voila! Elite with all the credits and cargo you can eat.

Unfortunately, the security code generated by this method won't fool those guys at Firebird and get you into the monthly play-offs.

Spectrum loads for Enterprise

Spectrum Basic programs can be loaded directly into the Enterprise computer, with the aid of Basic to Basic. Once the £19.95, program from Enterprise is running, tapes containing Spectrum Basic files can be loaded into the Flan. The program then converts the Spectrum Basic into Enterprise Basic, highlighting areas of the program which the user may have to rewrite.

Any Spectrum owners thus tempted to rush out and buy one might like to consider an bundling deal from McIntyre Marketing. Enterprise 128 and Fidelity TV/Monitor for £229.95, or Enterprise 128 with a cassette recorder and joystick adapter for £199.95. Anyone interested should contact McIntyre Marketing on 051-708 8141.

Battle of the Planets

Bryan Hulme, 24, an unemployed motor mechanic from Cheshire, has won the National Computer Games Championship. The contest, organised by Micro Gen was held on December 12th at the Savoy Hotel, London.

The four finalists had 15 minutes to battle it out on a new game called "Battle of the Planets" which is due out from Microgen around Christmas.

Hard News

PRICE SLASHERS

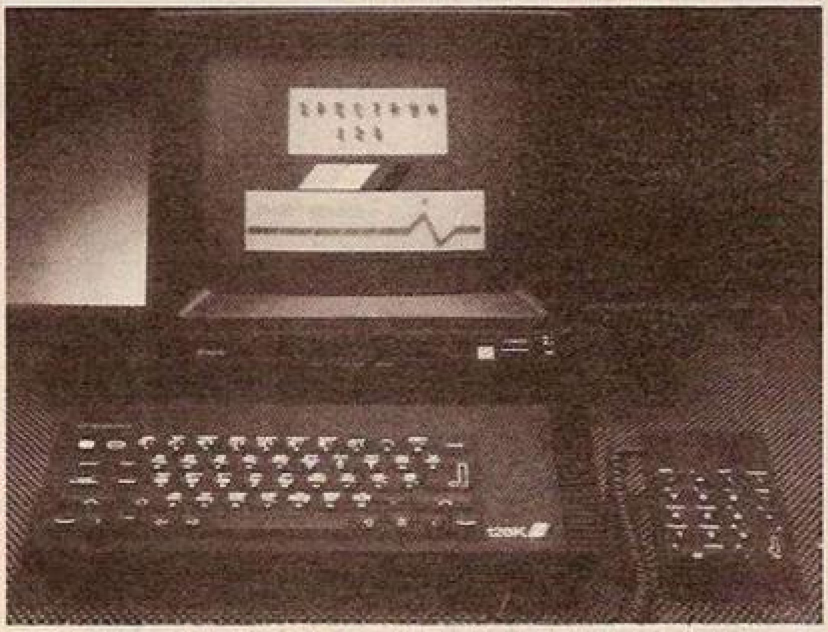
128 shake-up starts here

High Street giant W H Smith has dropped the price of the Sinclair Spectrum Plus to £99.95 in a bid to capture the elusive Christmas market. Meanwhile, the new 128K version of the machine is waiting in the wings. The long awaited Spectrum 128 is expected to make its debut early in 1986. When it arrives it will mean that the flagship machine of each of the major micro manufacturers will have the same memory capacity for the first time.

Elsewhere, the Spectrum Plus is being sold as part of a package including a joystick and interface together with some software, all for around £139. At Currys you can get all this plus a cassette player for the same price, however the recommended retail price of the micro remains at £129.

Commodore owners can trade in their old 64s for a 128, getting £50 off the current retail price. This brings down the cost of owning a CBM-128 to £220. Other computer owners cannot trade in their equipment, but will receive a free Datasette — which Commodore claim is worth £45, with any CBM-128 purchased at full cost.

Comet, Greens and Ultimate are selling the Commodore Plus/4, together with a Datasette, joystick and 10 pieces of software for just £99.99.



Spectrum 128: Sinclair's shy star waits in the wings.

Mickey Mouse contest

A trip to the Epcot centre is the prize on offer in an essay competition being run by the Association of Young Computer Enthusiasts.

The catch is that to enter, you have to be a member — which costs £5 a year. The other catch is that the closing date is January 15. The essay should not be longer than 2,000 words, and should describe a computer system for running a club. The Association is an offshoot of the British Computer Society, and for your £5 you get a monthly magazine, with competitions and special offers.

For more information contact Elizabeth Davies on 01-637 0471.

Big boys face cash crisis

Sinclair Research and Commodore Business Machines both announced losses during the last few weeks of 1985. Sinclair's figures for the year to March '85 were bad enough, showing a loss of more than £18 million, but Commodore, being American, had to go one better and managed to lose nearly £30 million in the three months before September.

While Sinclair's problems are blamed on the retailers — who overstocked by as many as 400,000 computers early in 1985. Commodore's woes are due to investment in new machines such as the 128 and the Amiga.

Commodore's figures are much worse than expected, and industry analysts in the U.S. claim that if these figures are not turned around quickly, the company could be in serious trouble.

On the other hand, Sinclair has done much better than most forecasts expected, especially so considering the abortive deal with Robert Maxwell last summer.

Currently Sir Clive Sinclair is trying to raise £10 million, in order to build the next range of computers.

Meanwhile if you are feeling charitable this Christmas, spare a thought for poor old Sir Clive — his wages have been cut from £77,000 to a mere £53,000.

DIARY

Some go East, some go West

He who laughs last laughs longest so we can look forward to large quantities of inscrutable oriental mirth. The in joke last year and early this year was MSX. The xenophobic, parochial Brits just couldn't take it seriously. Now the boot is on the other foot. By offering a quality product at a good price they are getting the sales. Next year MSX will be the best selling computer, globally.

Amstrad's current crop of machines are well made, well marketed and good value. They are not, however, technically interesting. This is obviously a situation that cannot go on forever. Their 68000, ½ megabyte, WIMP etc machine is a lot nearer than some people imagine. Amstrad are just much better at keeping things under their hats that most companies. On past performance we can expect better price/performance than the rest of the Amiga, S.T. crop. Especially when those three inch disk drives are rumoured to only cost Amstrad £12 a piece.

Next time you see screen shots in a game advert or insert card take a closer look. One or two software houses have got into the naughty habit of using C64 screenshots for the Sinclair Spectrum version. Some have gone so far as to use proper arcade machine screen shots on both the C64 and Spectrum versions. Slap wrists.

A certain Liverpool software house recently had a moderate hit with their version of "Underwurlde"

(continued on page 23)

Soft News

(continued from page 21)

So far so good, nothing unusual in that. What is surprising is that they are threatening to sue another Liverpool software house. They feel their copy has been copied.

Rumour about the Sinclair business computer seems to be firming up. Best guess is that it will use the OS9 68K multi-tasking operating system. This might have a wimp front end written by Metacomco, of Amigados fame. Most likely RAM is ½ a megabyte, though one megabyute is always possible. The end result is probably a cheaper, more elegant Atari 520 ST look-alike. Knowing Sinclair this could all be just a rumour.

On January 23rd at their Annual General Meeting in America, Apple will announce the Mac plus. With one megabyte of RAM a 128K ROM and double sided 800K disk drives it offers a potent package. Upgrade kits will be avilable for existing Mac Owners. In September Apple will offer an even more powerful Mac, codenamed Carla. This will have four megabytes of RAM and a built in hard disk. It promises to make an ideal games machine.

By selling off U.S. stocks of the BBC Micro to British American Scientific Instruments of Texas for just under a million pounds, Acorn has paved its way to the Latin American computer market. The Texan company has a Mexican parent organisation, Dataum, which has developed Spanish language software and a special keyboard to sell the computer to hispanic users.

As part of the deal Acorn has granted the company assembly rights to build and sell the computer throughout the Americas. Meanwhile, Acorn's parent organisation, the Italian giant Olivetti, will be selling the BBC Micro in Eastern Europe.

Elsie Dee

ELECTRIC FUTURE



Steven Spielberg may have the Midas touch — but with a 20th century embellishment: his movies turn into computer games. Hard on the heels of US Gold's Goonies comes Electric Dreams' Back to the Future — the movie that toppled Rambo from its number one US position.

Faithful to the storyboard of the movie, you zoom back in time in your psychedelic DeLorean and must bring your parents together — otherwise you cease to exist. At the bottom right-hand of the screen is a photo of three people which fades as time goes by, just like in the movie. Using digitised sequences from the film the icon-driven game breaks new ground in having an on-screen kiss! Sloppy, huh? But if your mom Lorraine and your pop George don't kiss, then you, Marty wil never exist.

The design concept was developed by Mark Eyles of Quicksilva fame and uses Huey Lewis and the News' Power of Love as background music. Scheduled for release at the end of this month, Back to the Future will sell at £9.95 on the CBM-64, closely followed by an Amstrad version.

ZAP A ZOID

Zoids, Tomy's popular cybernetic dinosaurs were around when Transformers were no more than a marketing concept. Now you can join in the internecine conflict on Zoidstar where the Red Zoids have smashed Zoidzilla, the Blue leader into eight pieces.

Martech's Zoids on Spectrum at £7.95 and the CBM-64 and Amstrad at £8.95, gives you a chance to claw your way to the top of the Zoid hierarchy until you control a Zoid yourself. Ths will make it a lot easier for you to assemble the missing bits of Zoidzilla.

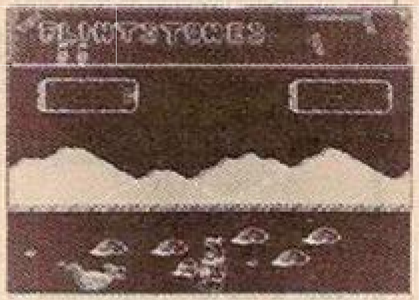
The game includes a 3D sequqnce in which you, as a guided missile zoom towards the evil Red Horn and try to destroy him. Zoids will be zoids.

Stone age

That modern stone-age family, the Flintsones, have been popping onto our screens in re-runs that seem to stretch back to the original Stone Age.

The aim of the game is to help Fred Flintstone build a house with stones from the local quarry and win the affections of Wilma his wife-to-be.

Players can win a holiday in Los Angeles including a visit



to Hanna-Barbera studios.

The Quicksilva game boasts excellent animated graphics and will be available on CBM-64, Spectrum and Amstrad at £7.95. Do Flintstones and Electric Dreams' Back to the Future augur a worrying new trend in games? In both you have to bring two people together instead of slaughtering hundreds of aliens.

Your letters

Write to: Your Letters, Your Computer, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Our Prestel mail box number is 01 9991 800.

BACK TO EARTH

Earthlings, I think your correspondent "Harry Seldon" — obviously a pseudonym — should stick to building his Foundations and not spout such twaddle about Aliens coming to destory us through mis-understanding our video games. After all, if they don't even recognise the games as such, how likely are they to recognise the zapping or the blobs, sorry — "invaders", as such?

Seriously, however, there has been much furore recently about Amstrad's twin-deck cassette unit, and about Interface III-type devices. Once again, we are told that such devices "breach copyright" and should therefore be banned.

There seems to be a misconception — deliberately fostered, in part, by the software houses themselves — as to what, exactly, copyright is and what rights the consumer gets under it. Contrary to popular belief, the copyright laws are not intended to block legitimate usage of items for which the consumer has paid good money. Magnetic media are not infallible; indeed, on the contrary, my experience is that protection schemes are self-defeating, forcing me to break the protection and make a copy simply so that I have one which will load.

It is true that these gadgets could be used to break the law, making multiple copies to give or sell to others, but "could be" is nowhere near strong enough a reason to ban them. Whilst condemning the lawbreaking potential of their customers, the software people all ride around in cars. Dont they know that cars could be used to kill people? That's far worse than a few illicit copies! So, let's ban cars, knives, headache tablets etc., before working our way round to the much lesser menace of copier devices and software.

Gaal Dornik,
Hardinville,
Terminus City,
Anacreon Sector,
Stardate: 6.12.85.

DOWN IN THE DUMPS

Goodness knows what Basic screen dump A J Torlesse was using for his Spectrum/HR5 system — Letters, November. I thought *my* routine — adapted from the Epson routine in *Mastering your Microdrive* — was slow at about 5½ minutes.

Got the time down to 1¼ minutes by modifying another routine and have ended up with the Tascopy suite of m/c routines for small and large

(continued on page 27)

Dear Eugene Evans,



I have had the pleasure of knowing you and your family for over five years. Then you were an enthusiastic and well-mannered 14-year-old. I employed you to work as a Saturday boy in my Liverpool shop, Microdigital. Being keen and intelligent you quickly became a microcomputer expert and a highly valued employee. As soon as you were old enough you left school and worked for Bug Byte and then Imagine. This was a great mistake.

Imagine seized on you as a PR opportunity. The story of working-class teenager earning a fortune in Liverpool was a natural for the mass media. You had a fleeting fame in newspapers and on television, with strong undertones of John Lennon involved. What you didn't seem to realise is that Imagine didn't do it as a favour for you, they did it for themselves. In fact what they did for you was the exact opposite of a favour.

Back in reality you wrote a simple game on the 3K Vic called Wacky Waiters that was just tolerable. Catcha Snatcha which followed was unplayable. Frantic was so bad the company had to withdraw it. Then you converted to the Commodore 64 with an attempt to put Arcadia on it: it was a travesty.

The last few months of Imagine were wasted playing around while pretending to work on a game called Psyclapse. All these attempts at programming were on the relatively simple 6502. You never could handle the more complex Z-80. The 68000 must seem as difficult as playing Rachmaninov backwards on a mouthorgan.

Now you are wisely not trying to program. The problem you have in life is that you are left with no skills or qualifications. You do have a misplaced loyalty that is seriously holding you up in life. The time has come to escape from the past. There is only one logical course of action. You must make the most of your undoubted potential by going back to school.

Bruce Everiss

IN TOUCH

How to write for Your Computer

We called this magazine *Your Computer* precisely because we welcome you views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting you name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

The article must be submitted exclusively to *Your Computer*. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Telsoft

Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC and the Commodore which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in hex

Message service

You can get messages to us in two ways. Either use the Prestel Telex Link to 892084 BISPRES G or you can use our very own modem, day or night on 01-661 8978. The modem is V21, 300 baud, even parity, 10 bits per character. You simply transmit in upper case "YRC" — our address code, and wait for the acceptance code "+ + + STF GO". Then off you go. Don't forget to tell us who it's for. Sign off with "NNNN" — again in upper case.

Your letters

(continued from page 25)

black-and-white copies, plus a "shade copy" which prints sideways to give a near-A4 size copy with shading of increasing density simulating the screen shades from white through the colours to black. The code for each is only 256 bytes long, and resides the printer buffer, not used except for printing to the ZX printer.

There's also a probable reason for his Poking, in that the early HR5s had an incremental feed of 1/36", whereas the current model is twice as fine, with 1/72". Thus for bit image printing the control code had to call for 4 times 1/36" for a 1/9" feed, but now requires 8 × 1/72" for the printer to advance the paper by the same amount.

Incidentally, Brother changed my HR5 from 1/36" to 1/72" feed free of charge when I dropped it in at their Manchester service centre.

I've seen so many different cable connections stated for the Spectrum-HR5 link, some of which could *not* work, that I quote the "official" connections as stated by Brother.

Interface	**HR5**
2	2
3	3
4	20
7	7
5	5
and link	4
to	6
and	8

in the HR5 plug.

QL	**HR5**
1	1
2	2
3	3
4	20
5	5
and link	4
to	6
and	8

P R King,
Hassocks,
Sussex.

RECURSION, AGAIN...

In First Bytes November '85 you have said that Forth has an advantage over Basic in its ability to support recursion. It has been stated so many times that you cannot do recursive techniques with Basic that some people are even beginning to believe it! It isn't true.

Any computer with Gosub and Return commands can solve any recursive problems. The only stipulation is that the return addresses must stack so that you can nest the subroutine calls. This not only means that Basic is perfectly suitable, it probably also means that virtually any language will support recursion whether high-level or assembly language.

It is easy to write recursive programs for a ZX-81 or Spectrum and I guess even Commodore Basic would do. The best book which explains how to do it is *The Complete Programmer: A Guide to better programming in Basic* by Mike James. This dedicates a chapter to recursion and gives a first class treatement of the subject.

Peter Erskine,
Colchester.

DRAWER

I feel I must write in and congratulate Paul Rhodes on his excellent program Drawer, *Your Computer* November '85, for the Sinclair Spectrum. As Paul points out, it is not possible to see the attribute grid if using the program with an RGB monitor, however it is possible to alter the program to make the grid visible.

Simply Poke 26613 with 32. This will make the attribute grid white and green and is perfectly satisfactory. You can use any other colour by Poking the above address and the formula Paper × 8 — i.e., green is Paper 4 × 8 = 32.

As far as I am aware this has no detrimental effects on the rest of the program. By the way this has no effect on the transparent grid and this still does not show up on a RGB monitor.

Anthony Challis,
Peterborough,
Cambridgeshire.

LAST MONTH

Part of listing two in Roy Dictus' Sound Sampler, published in December, has been smudged. The last six characters in the second and third lines from the end — Line 110—should read:

f7ed78
4c04c9

If you are having trouble with October's Spectrum Melody Master, note that there should be a plus sign at the begining of line 810, ie.,

810 LET NO = NO + ...

AUTODIAL WITH TELSOFT

There appears to be a slight problem with my Autodialler program, published in your November issue. It works perfectly with the D1 and D2 programs that are available on Telsoft, but won't work with the Telsoft listing in the magazine, as they have different start addresses. To allow for this, line 1240 of my program should be:

1240 DATA76,56,199,32,53,
193,96,234,234,234

if you are using the Telsoft listing on page 102.

David Derrick,
Cheddar,
Somerset.

SCRABBLE A CHEAT?



In September's Update you talked about reworking old games. Chess programs are regularly updated, so why doesn't somebody do the same for Backgammon and Scrabble?

CP Software describe their Backgammon as "excellent". Not true. No doubling cube, no score, very little colour. It doesn't compete with Psion's and that one has its problems. Psion's Backgammon occasionally generates extra pieces for me and then hangs up by not allowing me to play my last piece into my home table if it's on the bar.

Psion's Scrabble is super but, oh, some of those words: "squits" and "vison" do not appear in any of the dictionaries that I have — Chambers and Pocket Oxford.

Please all you superb programmers can we have updates of Backgammon and Scrabble for the good players out here, professional jobs too — no kid's stuff.

I'll buy two of each. And if ever I see Scrabble for the Amstrad 6128 based on a good dictionary I'll buy a 6128.

Peter J Turner,
Norway.

POOLSWINNER



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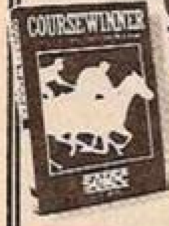
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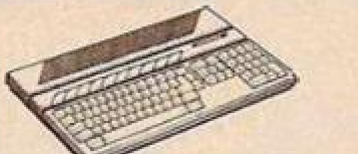
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multiface one ™ Version '86

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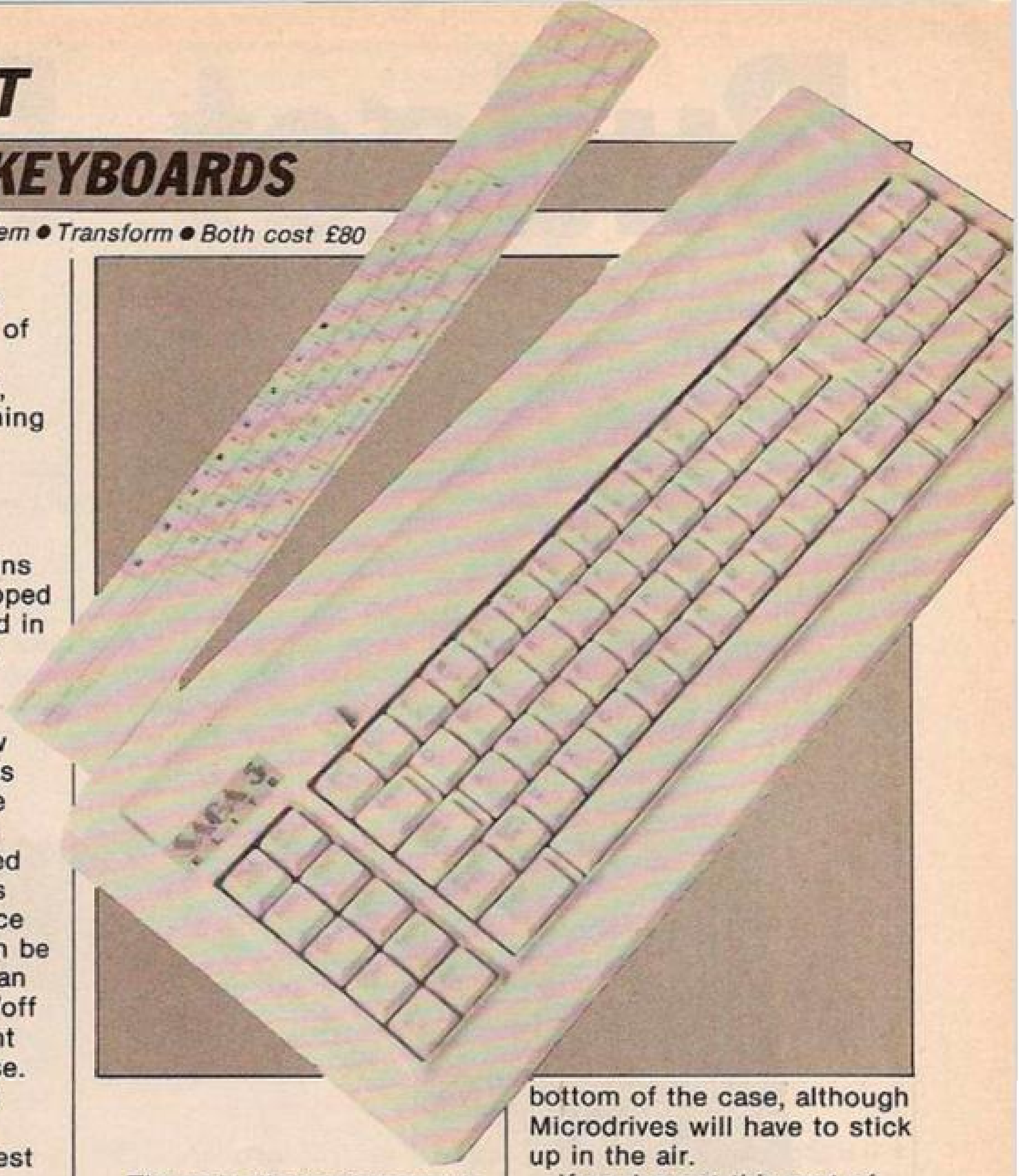
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HARDWARE HITLIST

SPECTRUM KEYBOARDS

▶ *Spectrum* ● *Saga System* ● *Transform* ● *Both cost £80*



What do you get the Spectrum owner who has everything? Possibly one of the two new deluxe keyboards. At around £80, they have to offer something a bit special.

The new Transform keyboard looks likely to stand up to anything. A diecast metal case contains a full set of sculpted stepped keys. These are embossed in colour with the Spectrum keywords.

There is a separate numeric keypad and a few separate functions keys as well as an extended mode key. Fitting is simple and just needs the top whipped off the Spectrum. There is plenty of room for Interface 1, and the Microdrives can be connected without using an extension. There is an on/off switch, and room to mount the transformer in the case.

As you might expect at this price, the feel of the keyboard was up to the best professional standards.

The other contender, the Saga Elite 3 goes for a plastic IBM look alike keyboard. Again the feel is very nice. They have gone a bundle on extra function keys. No less than 10 down the left side with a full numeric keypad with cursor keys and arithmetic operators.

The only disappointment is the lack of keywords on the keys. These are supplied on a chart which clips just above the keypad. Not a problem for the Spectrum fanatic, but off-putting for the casual user.

Hardware compatibility is maintained by keeping the board in the same position in relation to the back and bottom of the case, although Microdrives will have to stick up in the air.

If you've got this sort of money to spend on a keyboard, then there isn't much to choose between the two. For me the Transform gets it by a short head because of the colour embossed keys and last-for-ever metal case. Transform telephone number is 01-658 6350 and Saga are on (04862) 22977.

OPPOSITE
● The Saga 3 Elite. For the Spectrum owner who would rather be tapping away on an IBM PC.

MULTIPORT

▶ *Skywave* ● *RS232 interface* ● *Any Amstrad* ● *£99.95*

The unit consists of a full 25-way connector, two sideways Rom sockets and a 24-way user port. One of the Rom sockets is occupied by the Skycom software, and as yet no software has been written to use the user port; it may eventually be used to control intelligent modems for unattended operation.

The two main tasks of software like this is to access Prestel and bulletin boards. In Prestel mode, there are four colours instead of the usual eight. Some dynamic pages seem a problem, but apart from that, it does an adequate job. Pages can be printed or stored in Ram or disc/tape, although it was unclear how to retrieve pages from storage for printing. Most commands are accessed using cntrl + key combinations, with windows and menus to help.

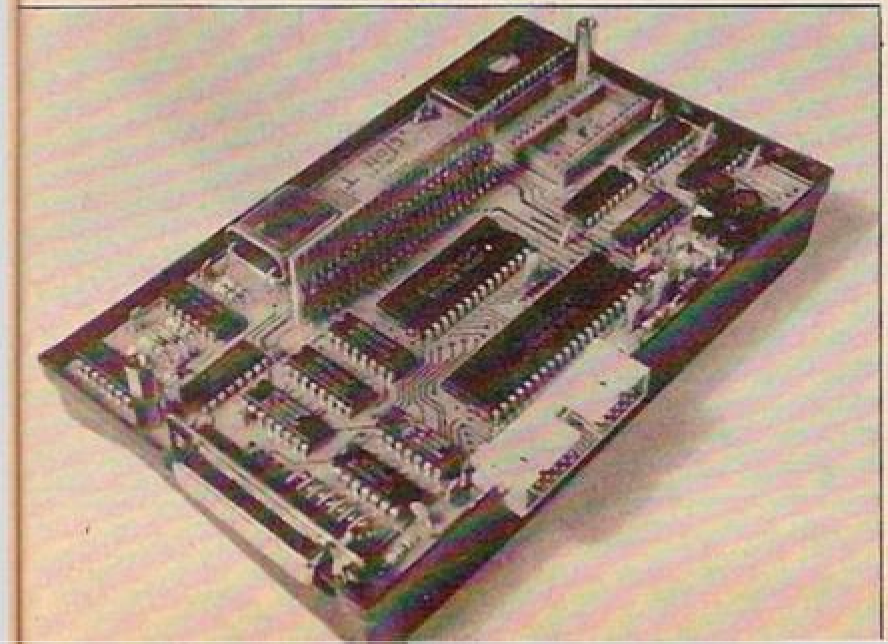
The bulletin board software has the usual choice of parameters for baud rate, word type and 40/80-column option. The same printing and saving facilities are available.

This looks like a promising package. Obviously there are many facilities one would like which are absent — file transfer and offline mailbox editor to name but two.

At the moment it has stolen a march on the competition where software downloading is concerned, but the dismal standard of software available does not make this a winning advantage.

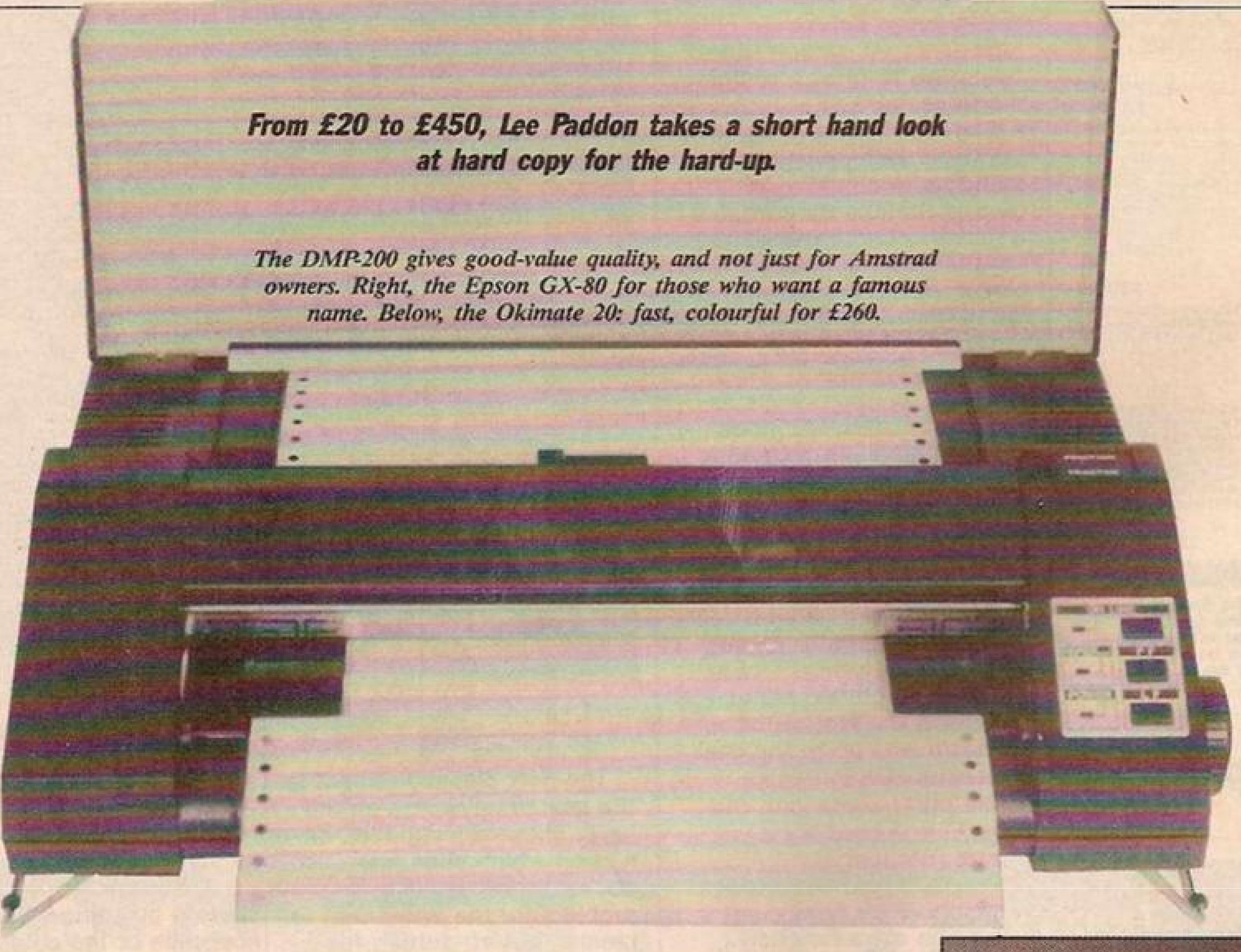
Multiport is available from Skywave on 0202 302385. The interface plus modem deal is from Modem House. ●

BELOW
● The Skywave Multiport lets you plug in to free Prestel software for £100.



Budget Printers

From £20 to £450, Lee Paddon takes a short hand look at hard copy for the hard-up.



The DMP-200 gives good-value quality, and not just for Amstrad owners. Right, the Epson GX-80 for those who want a famous name. Below, the Okimate 20: fast, colourful for £260.

A printer is often the first add-on that new users consider when they decide thier micro is going to be something more than a games machine. It is vital if you want to do your own programming as it is impossible to see your whole program on the screen at one time and thus root out persistent bugs. You may also want to use you computer as a word processor — the most important "serious" application for home micros.

For listings, almost any printer will do. Obviously speed is useful as this will allow you to get on with the job more quickly. Print quality and paper size are probably less important. On the other hand, if your major application is word processing, then your major criterion will the appearance of the finished work. There is no point spending time and effort getting the spelling and appearance right if it's printed illegibly on paper which would look more at home on a toilet roll.

Another application is graphic presentation. This is important if you want to use your computer to plot graphs, charts, or do screen dumps. For this sort of work the important thing to bear in mind is whether the software you have will drive the printer you want and whether you need colour.

There are four basic varieties of printer which use different methods of forming characters: dot matrix, where characters consist of a series of dots, a daisy- wheel, thermal printers and plotters.

Plotters consist of one or more coloured pens which are moved over the paper to produce lines and characters. Up until recently these were very expensive but there are now several makes which produce accurate results for a reasonable outlay. Some are flat-bed plotters, which work on a single sheet of A4 or A3. Others like the much cloned MCP-40 have roll feed; possibly only worth considering if you are primarily interested in graphics as they are usually too slow for general-purpose work.

Daisy-wheels were once considered the Rolls Royce of printers, being mainly found in offices. However, they are rapidly falling in price, and you might be able to pick up a second-hand bargin. But they are quite slow and have no graphics capability. Be careful about availability and price of ribbons.

Thermal printers are about the cheapest way of getting into print. An outstanding example is the Alphacom printer from Dean Electronics, which is now available for the Spectrum at £20. Softek also does an interface for CBM-64 and Vic computers. Brother also has a range of thermal printers which are good value. The main drawback with this type is they are somewhat sluggish and the paper is costly and sometimes not readily available.

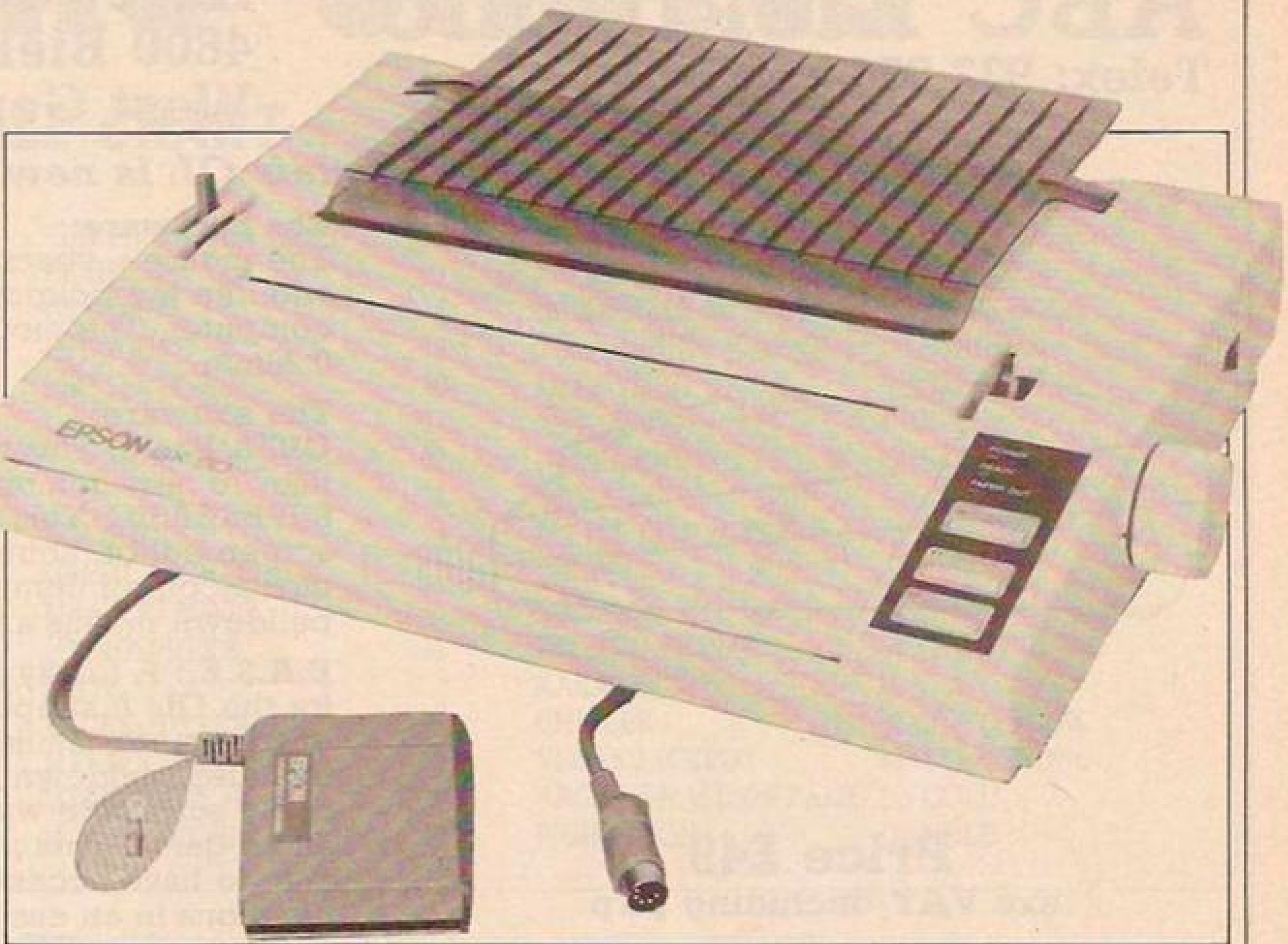
Lastly, there are dot matrix printers. Frankly if you can afford around £300 for a printer you should look no further. Within this class you should find a printer to suit you needs. Ideally it should be Epson



compatible — i.e., its graphics and character set should conform to those of the Epson printer range. It should print with a range of character sets, including NLQ, and you should be able to redefine the character set.

Buffers are also useful; your computer is free to get on with computing while your printer does the printing. NLQ — or Near Letter Quality — is a recent development. The printer prints a line twice, the second time half a dot lower. This increases the vertical resolution to the standards of daisy-wheels. Most printers now offer this facility and it really is a must these days, even if you're only going to use it for your CV or to impress the bank manager.

Laser and inkjet printers are starting to make an impression in business. How long before their presence is felt in the home market is hard to foresee. The major advantages of these printers are speed and quietness. These are not important considerations in the home market unless their prices change dramatically. Epson has plans to launch a smaller version of the SQ-2000 to match its portable computer but its performance is not that much better than many dot-matrix printers.



If you need colour you now have a number of technologies to choose from. There are dot-matrix printers from Epson and Seikosha which use multi-coloured ribbons to produce up to eight colours. Plotters normally come equipped with a variety of pen colours and some, like the Penman plotter, will take Pentel pens, giving you a wide variety to choose from. Another approach is the Okimate 20 which claims to produce up to 100 different shades. At £259 it is certainly very competitive even offering a correspondence quality type-face.



If colour isn't important but you want the flexibility of dot matrix and NLQ then the Amstrad DMP-2000 is a good choice at £159. It has a standard Centronics interface, although the cable you get thrown in will be useless and the colour scheme may jar a bit. The manual is very clear and also written with other computers in mind.

Epson has dominated the upper end of the market for a long time with its FX and MX range. These workhorse printers have aquired a deserved reputation for reliability. However, in terms of facilities for the money, they may well not be the best value for money. The Taxan KP-810 gives a spritely 160 cps — characters per second —with a choice of three NLQ faces as opposed to the single NLQ face of the comparable Epson LX-80.

Also worth considering is the Star range of printers. One of their important plusses is that some use normal, cheap and readily available typewriter ribbons so running overheads will be low. Generally, they are a little more expensive than the Taxan and offer similar facilities. Another consideration for Spectrum and Commodore owners is the interface. For the Commodore, more and more manufacturers are bringing out CBM versions of their printers, including Star, Brother and Epson.

There are a number of Spectrum printer interfaces on the market. Probably the best known is the Kempston interface. Although expensive, it offers all the facilities you are ever likely to need and is compatible with a wide range of printers.

Printer technology is a never-ending source of ingenuity and, despite the basic requirement of delivering ink to paper, is one of the fastest moving areas in the home computer world. At the moment dot matrix would seem to offer the best all round performance and there are some excellent deals on offer this Christmas.

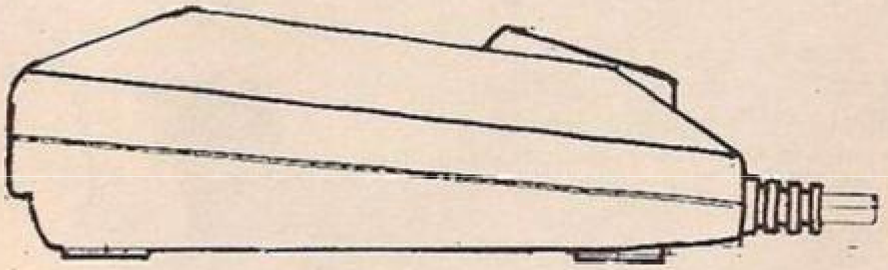
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The mouse + special interface to use with the joystickport of the QL computer. The mouse resolution is 0.26mm.

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E.A.S.E.: A totally new user interface for the QL. It supports a desktop environment, similar to GEM. It includes pulldown menues, icons, really scrollable windows, a calculator and a game. This program enables the user to have access to all system functions in an easy manner.

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- ★ Every stand was taken at the October show, and many potential exhibitors had to be turned away. This time they've booked well in advance! Well over a hundred exhibitors will be there.
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The charts

TOP 30 OVERALL CHART

1	ELITE	FIREBIRD/ACORNSOFT
2	COMMANDO	ELTIE
3	WINTER GAMES	US GOLD
4	THEY SOLD A MILLION	HIT SQUAD
5	FORMULA ONE SIMULATOR	MASTERTRONIC
6	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE
7	COMPUTER HITS (10)	BEAU JOLLY
8	MONTY ON THE RUN	GREMLIN GRAPHICS
9	FINDERS KEEPERS	MASTERTRONIC
10	BACK TO SCHOOL	MICROSPHERE
11	FRANK BRUNO'S BOXING	ELITE
12	BEACH HEAD 2	ACCESS/US GOLD
13	BMX RACERS	MASTERTRONIC
14	FIGHTING WARRIOR	MELBOURNE HOUSE
15	ACTION BIKER	MASTERTRONIC
16	RAMBO	OCEAN
17	DALEY THOMPSON'S SUPER TEST	OCEAN
18	IMPOSSIBLE MISSION	EPYX/US GOLD
19	YIE AR KUNG FU	IMAGINE
20	LAST V8	MASTERTRONIC
21	SABOTEUR	DURELL
22	NEVER ENDING STORY	OCEAN
23	TOMAHAWK	DIGITAL INTEGRATION
24	LITTLE COMPUTER PEOPLE	ACTIVISION
25	ROBIN OF THE WOOD	ODIN
26	INTERNATIONAL KARATE	SYSTEM 3
27	CHILLER	MASTERTRONIC
28	VEGAS JACKPOT	MASTERTRONIC
29	ARCADE HALL OF FAME	US GOLD
30	FIGHT NIGHT	US GOLD

BUBBLING UNDER

1	FRIDAY THE 13TH	DOMARK
2	GOONIES	U.S. GOLD
3	SUPERMAN	BEYOND
4	NOW GAMES 2	VIRGIN
5	GYROSCOPE	MELBOURNE HOUSE
6	ROCKMAN	MASTERTRONIC
7	THUNDERBIRDS	FIREBIRD
8	SWORDS & SORCERY	PSS
9	CAVES OF DOOM	MASTERTRONIC
10	SPELLBOUND	MASTERTRONIC

COMMODORE SALES

THIS	LAST	MTHS	TITLE	PUBLISHER
01	01	2	WINTER GAMES	US GOLD
02	NE	01	COMMANDO	ELITE
03	NE	01	RAMBO	OCEAN
04	NE	01	LAST V8	MASTERTRONIC
05	NE	01	LITTLE COMPUTER PEOPLE	ACTIVISION
06	NE	01	FIGHT NIGHT	US GOLD
07	03	02	SUMMER GAMES 2	EPYX/US GOLD
08	NE	01	THEY SOLD A MILLION	HIT SQUAD
09	02	02	WHO DARES WINS 2	ALLIGATA
10	NE	01	RACING DESTRUCTION SET	ARIOLASOFT

AMSTRAD SALES

THIS	LAST	MTHS	TITLE	PUBLISHER
01	NE	01	THEY SOLD A MILLION	HIT SQUAD
02	05	02	GRAND PRIX 3D	SOFTWARE INVASION
03	06	02	FORMULA ONE SIMULATOR	MASTERTRONIC
04	01	02	FINDERS KEEPERS	MASTERTRONIC
05	08	02	SOUL OF A ROBOT	MASTERTRONIC
06	NE	01	YIE AR KUNG FU	IMAGINE
07	03	02	NONTERRAQUEOUS	MASTERTRONIC
08	NE	01	CHILLER	MASTERTRONIC
09	NE	01	RAID	US GOLD
10	02	02	WAY OF THE EXPLODING FIST	MELBOURNE HOUSE

SOURCE: GALLUP/MICROSCOPE

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04	02	02	DALEY THOMPSON'S SUPER TEST	OCEAN
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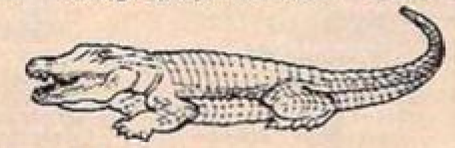
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```
  10 FOR n=1 TO 10: PRINT n: NEXT n
as:   10 FOR n=1 TO 10
           PRINT n
        NEXT n
```

- KEYWORDS can all be entered by typing them in full, or by the "single entry" method, or both in the same line; e.g. the line: 10print"hello":if x=1 THEN goto 100 will be recognised and listed normally.
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COMMANDO

▶ *Spectrum & Commodore 64 • Elite • Arcade • £7.95 and £9.95 • Paul Bond*

GRAPHICS
● ● ● ● ●
SOUND
● ● ● ●
PLAYABILITY
● ● ● ●
VALUE FOR MONEY
● ● ● ●
OVERALL RATING
● ● ● ●

SCREENS

• Commando: An amazing programing feat.

Bitter battling has not been confined to the game itself — Elite forced Alligata to make alterations to their excellent Who Dares Wins II in order to delay its production — and it would seem both games are superseded in complexity and variety by Ocean's Rambo.

What all the games have in common is an upward scrolling sceanario depicting a feisty little soldier battling his way past the enemy, past gun emplacements, bridges all the way to the fortress.

This game is particularly striking on the Spectrum — the animation and detail are so good it makes Sir Clive's little box of tricks look like an arcade machine. The sound quality on the Commodore is excellent and adds to the whole atmosphere of



generally frothing stupidly at the mouth that is essential to partaking in warlike activity.

Developed with the aid of Capcom to create the closest possible duplication of the original arcade game, Elite's Commando has the cachet of being the official version. A lot of people will think they are doing well if they get as far as the fortress wall, but beyond here there are troop carriers and tanks to defeat.

RAMBO

▶ *Commodore 64 • Ocean • Arcade • £9.95 • Paul Bond*

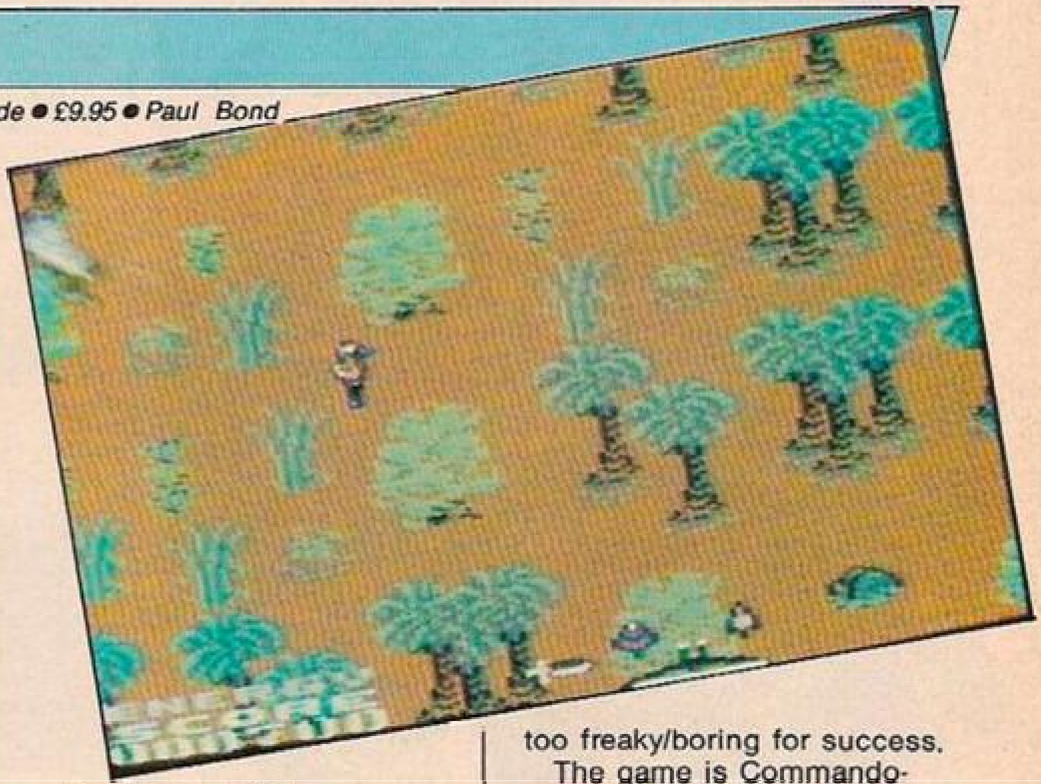
GRAPHICS
● ● ● ●
SOUND
● ● ● ● ●
PLAYABILITY
● ● ●
VALUE FOR MONEY
● ● ● ●
OVERALL RATING
● ● ●

SCREENS

• Rambo: Just one of those sixties kids who decided to make war, not love.

Rambo is just one of those sixties kids who decided to make war not love, and even in the US Army declined to use the Sylvester Stallone creation as part of their recruiting drive — it was not the kind of thing they wished to be associated with. Stallone fans are probably fed up with being told that their hero spent the Vietnam war working as a gym coach in a girls' school in Switzerland — but maybe it proves that he's smarter than he looks.

Now to review the game. Martin Galway's excellent soundtrack ensures that this will probably be the biggest thing to hit the market since Ghostbusters — especially since Activision's contributions this Christmas

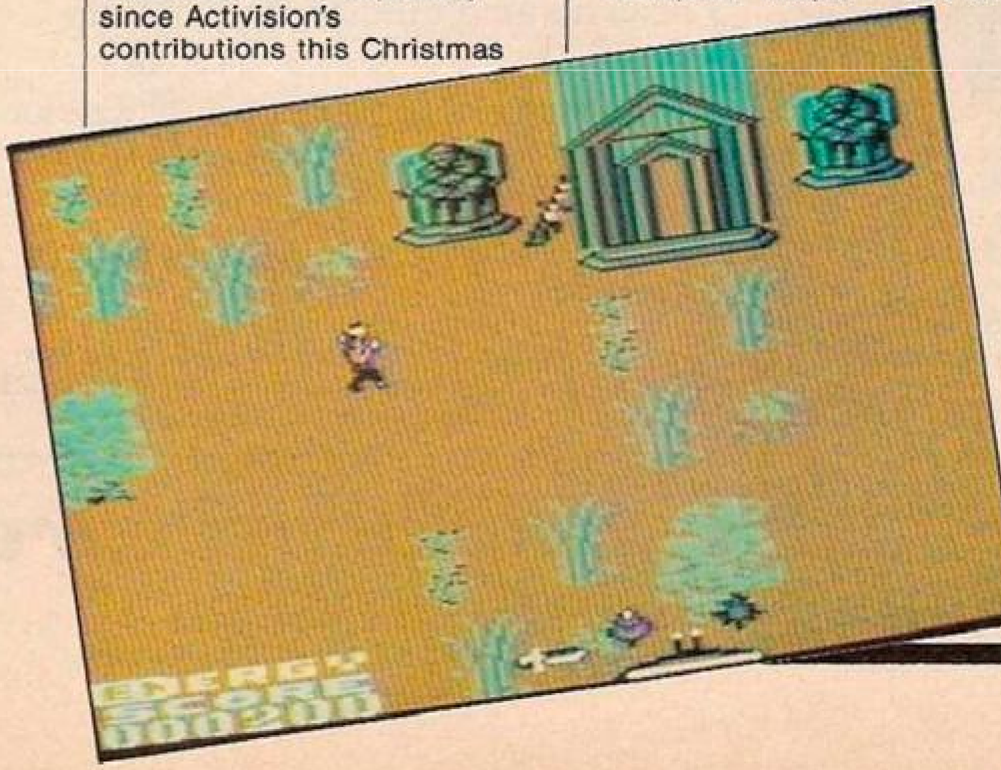


— Hacker and Little Computer People — are far too freaky/boring for success.

The game is Commando-esque, it must be said, but the greater variety of weapons and the ability to move back down the screen make it radically different from the two Commando clones currently available. There is more plot and strategy, too. You discover Banks, your former comrade in the compound.

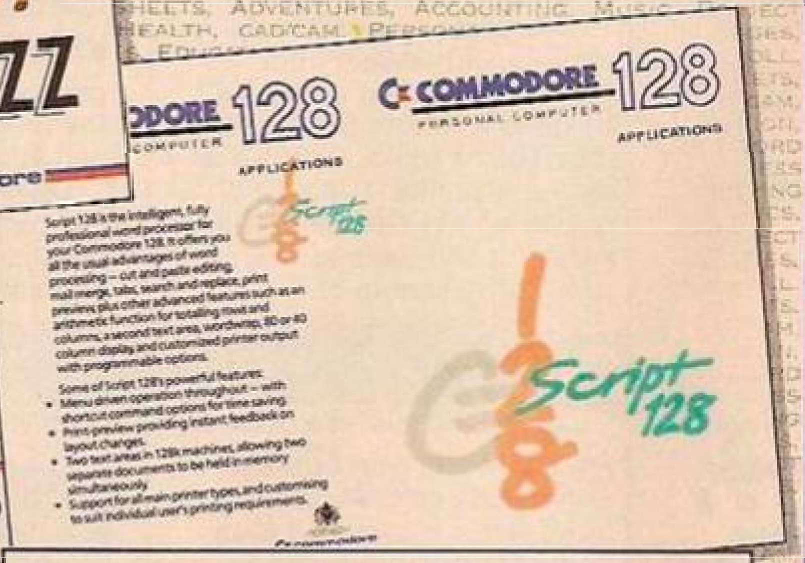
The screen display makes use of icons, using the space bar you can choose between explosive arrows, rocket launchers — everything the well-dressed man-about-jungle is wearing these days.

Strategy requires you to approach the camp as quietly as possible.



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SOFTWARE SHORTLIST

REPTON II

▶ BBC ● Superior Software ● Arcade Adventure ● £9.95 tape £11.95 disc ● Simon Beesley

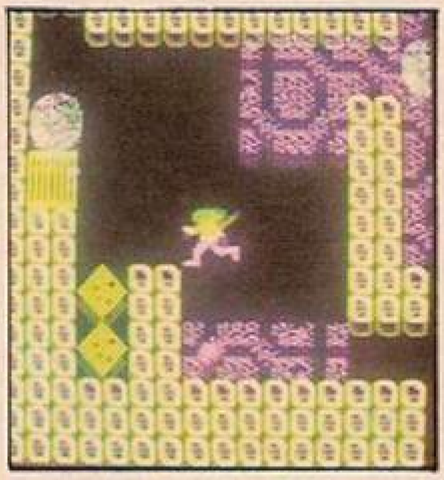
GRAPHICS
● ● ●
SOUND
● ● ●
PLAYABILITY
● ● ● ●
VALUE FOR MONEY
● ● ●
OVERALL RATING
● ● ●

SCREENS

● Repton II: A rattling good play

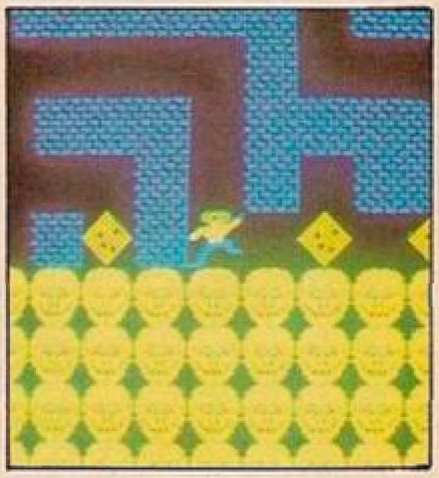
When you'd got over the fact that it wasn't Boulderdash — despite the teasing similarities — Repton II turned out to be a pretty good game. More relaxing than rivetting, it placed the emphasis firmly on problem solving and map making, rather than strenuous activity.

Repton II is more of the same with a new twist in the form of Transporters. As before you tunnel through the earth collecting diamonds, keys, and pieces of a jigsaw puzzle. This time, though, there are 64 Transporters to whisk you from one of the 16 levels to another. The trouble is, the transport system in Repton II makes British Rail seem a model of efficiency. There are no signpost's so the only way to discover where you are going to end up, is to step into a transporter and see.



Advance planning is vital; otherwise you might re-materialise two stages back, or in a cul de sac. And once you have used a transporter it self-destructs.

Stamina is also a factor. To complete the game you must dig out 4744 earth sections, collect 1634 diamonds, kill all 18 monsters, use all 64 transporters, pick up 42 jigsaw puzzle pieces. Do this



before April 1986 and you'll be in the running for a T-shirt bearing the legend, "I've completed Repton II".

It is still hard to avoid comparisons with Boulderdash — the rocks are too few and play only a minor part in the game. There is also an irritating flicker at the edges of the screen when it scrolls sideways. But Repton is a rattling good play.

CITADEL

▶ BBC ● Superior Software ● Arcade Adventure ● £9.95 ● Simon Beesley

GRAPHICS
● ● ●
SOUND
● ●
PLAYABILITY
● ● ●
VALUE FOR MONEY
● ● ●
OVERALL RATING
● ● ●

SCREENS

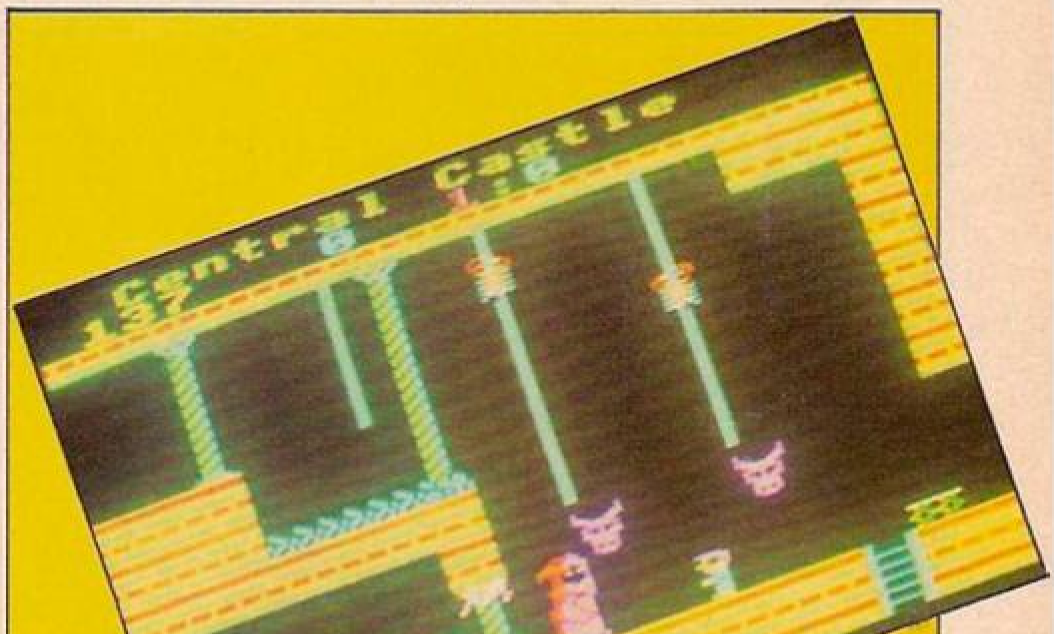
● Citadel: 100 screens — is this a record?

100 screens, a host of animated characters, secret rooms, a teleport system...Excited? Well, maybe not. Even on the BBC, epic arcade adventures are nothing new.

But new titles of any sort on the BBC are scarce these days, so owners should certainly be grateful for Citadel. And, to be fair, 100 screens is probably a record number to pack into the machine's limited memory space.

The game's graphics and general level of invention are not in the same league as Castle Quest's. But Citadel is a tough nut to crack, nonetheless. Even getting past the first few screens proved almost too much for this reviewer.

One of the nice things about the game is that you don't lose lives but energy. Falling down a chute leaves you severely weakened rather than dead. If you get caught in the grips of something nasty, manual control is overrridden and you are hurled back across the room to the point where you came in. Losing your life by running into a toxic bush or mistiming



a jump is the more normal fate in arcade adventures, so this kind of safety scheme is a welcome feature.

Also pleasing is the sheer variety of different locations. The story so far is that Marduk the Dictator has set up camp in an old deserted castle. Your job is to find the five crystals on the island, teleport yourself to his redoubt on an alien planet, and locate the bejewelled figurine. Then it's back to Earth in time to destroy the teleport system.

Interplanetary travel in an arcade adventure can't be bad, and the scale of the game makes up for any lack of novelty.

TAU CETI

▶ *Spectrum ● CRL ● Shoot'em-up ● £9.95 ● Lee Paddon*

GRAPHICS ● ● ● ● ●
SOUND ● ● ●
PLAYABILITY ● ● ●
VALUE FOR MONEY ● ● ● ● ●
OVERALL RATING ● ● ● ●

It seems that the days of the old meat-and-potatoes shoot-'em-up may be numbered. Spectrum owners are having to handle ever more sophisticated craft. In Tau Ceti your skimmer is positvely bristing with missiles and lasers. You also have scanners, an on board computer, and even a computerised memo pad! A cross between a sort of 2D Elite, Legend's Complex and Impossible Mission, you start the game with a map of the major cities on Tau Ceti. Apparantly it's another bad case of revolting robots.

You've got to go in there and blow away all the robots and restore order out of chaos by shutting down the reactor. To do this you have to visit each city in turn, skimming along the ground. You have to dock with the reactor substations and pick up cooling rods. These have to then be assembled and then you enter the main reactor building.

Meanwhile you have to fight off various hostile forces using lasers, missiles, anti missiles and flares. The flares come in handy at night especially if your infra red night vision has been put out of action. You must also try to avoid shooting "innocent" buildings. You start off docked with your main supply ship, to which you must return for all but the most minor repairs and supplies. At this stage commands are entered to your computer as words.

There are 20 of these commands, which basically help you move around the planet and assemble your fuel rods. Entering "launch". will put you into flight mode which gives an out of the cockput view in any direction of the planet's surface. Your instruments tell you how much ordinance you've got left and give a scan of objects in your vicinity, there is also a little window for the computer to give you cheerful messages like "your laser is mangled".

Tactics seem to be the usual mix of agression tinged with caution. It's tough to work out what's shooting at you when you've zipped into the middle of town at high speed, but on the other hand, it's against the clock. Sorting out the reactor rods is not easy either.

A well thought out game with a strong overall theme linking up the series of essentially straight forward shoot'em-up scenarios. Only one difficulty level, so to start off with, you hardly get out of the airlock.

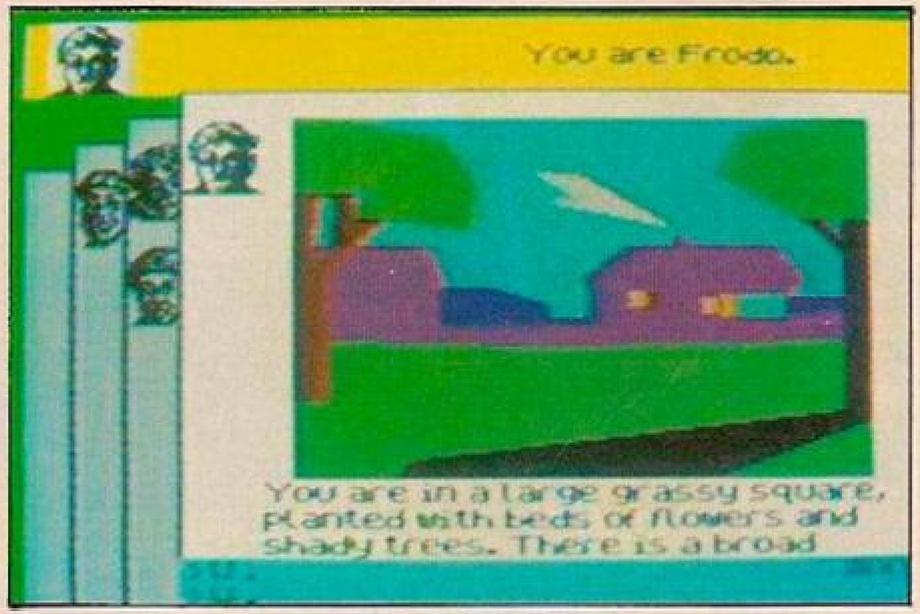
LORD OF THE RINGS

▶ *Spectrum ● Melbourne House ● Adventure ● £15.95 ● Paul Bond*

GRAPHICS ● ●
SOUND ● ●
PLAYABILITY ● ● ● ●
VALUE FOR MONEY ● ● ●
OVERALL RATING

SCREENS

● Lord of the Rings: Anachronisms abound.



I was Merry. The hobbit, you understand, not the state of mind. And as Meriadoc Brandybuck, the first thing that struck me about Michel Delving is that it looked rather like its name — a small suburb whose branch line station was probably closed down by Beeching in the early sixities. In short, the graphics in this game show a distinct lack of enterprise. Things have moved on since the legendary days of Melbourne Houses's first foray into Middle Earth, The Hobbit, and while the structural side of this program is excellent, I suspect something a little more eye-catching is needed to tempt the punters away from their zapping.

Another worrying thing about this game is the incursion of certain furturistic anachronisms. In the beginner's program Frodo looks at a noticeboard which has some photographs pinned to it. Now although hobbits smoke and love to compile family trees, one thing that The Lord of the Rings is thankfully free from is continued heated debates between Merry and Pippin as to the F-stop their cameras should be on when they see a flock of Nazgul flying by. There would have been whole chapters where the irrepressible hobbits tried to cajole the preoccupied Gandalf into posing for a shot — giving a lump of sugar to Shadowfax, maybe. And you can imagine how difficult it must have been to get colour film in the land of Mordor, especially since Sauron cancelled his subscription to *Amateur Photographer*.

Give'em their due, it's true to the map, in the book. Get on to the main east-west road through the Shire, leading east and you'll soon come to the Last Bridge. Melbourne House have designed it lovingly, obviously based on the programmer's favourite bridge on the M5. All that is missing is a sign telling how far it is to Heston Services.

There is a bit of a problem with Black Riders at this time of the evening, of course, but if you know the back doubles, south through the forest glade, east into the thick forest and back up north

THINK

▶Spectrum ● Ariolasoft ● Board-game ● £7.95 ● Lee Paddon

GRAPHICS ●●●●●
SOUND ●●●
PLAYABILITY ●●●●●
VALUE FOR MONEY ●●●●
OVERALL RATING ●●●●

SCREENS

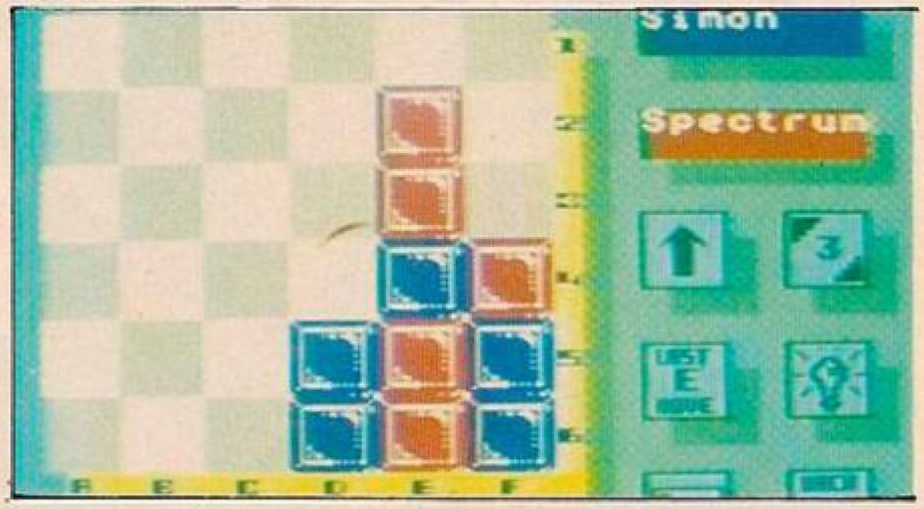
● Think: Very well presented.

Board-games on computers have had a chequered history. Playing games like Connect-4 is just as easy with a pencil and paper as on a computer. But Ariolasoft think they have a winner on their hands with a board-game which can only easily be played on a computer.

The board consists of a six-by-six grid. You play counters alternately to either the bottom row or the right-hand column. If you play to a column, that column, all counters and spaces, move up one, and the same with rows. The object is to get four pieces in a row Connect-4 style.

The fact that a whole row or column moves when just one piece is played makes it very hard to look more than a couple of moves ahead to try and force a win.

The game is designed by Tigress Marketing, and a lot



of time and effort appears to have gone into attractive presentation.

The "front-end" of the game is nicely designed, with icons allowing you to select various game options. Seven levels of computer opponent, normal, timed or "blitz" play, sound, colour and joystick options.

Although easy to learn, it takes a great deal of time to master. Even beating the computer at a low level is quite an achievement. At the higher levels the computer takes rather a long time, but you can prompt it to move when you get fed up. There is a tutorial mode, where the computer gives you points for the quality of your moves, there is a problem-solving mode and a move take back feature. An intriguing, original board-game well presented.

GRAPHICS ●●●●
SOUND ●●●
PLAYABILITY ●●●●
VALUE FOR MONEY ●●●●●
OVERALL RATING ●●●●

through the ravine with unclimbable sides, you can dodge this particular bottleneck. The Shire Watch are experimenting with contra-flow, but if you keep you palantir tuned to MEBC (Middle Earth Broadcasting Corporation) or one of the local stations you should make Rivendell and be quaffing a few ales at Elrond's gaff in no time flat.

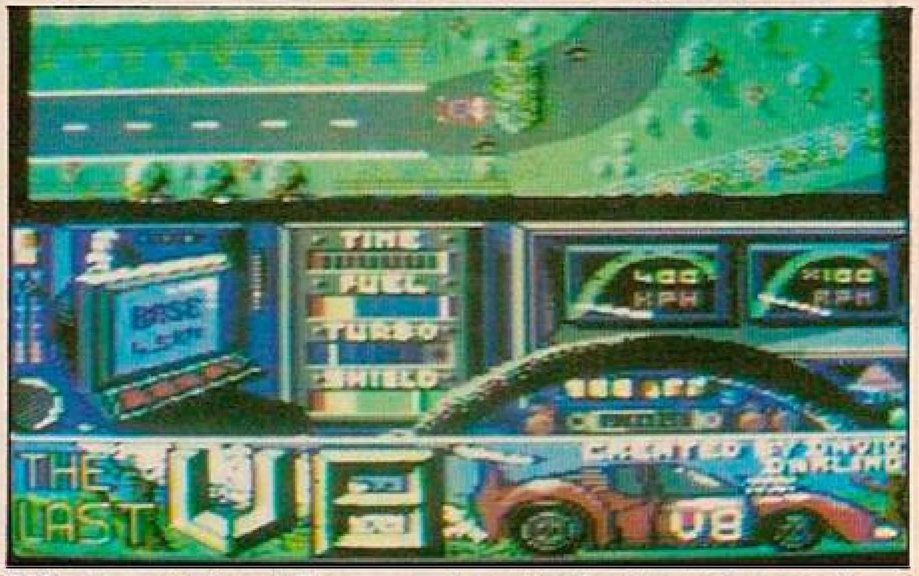
Melbourne House's special English language is supposed to make adventures less hard to play — but real adventurers will be glad to know that things have not really been made easier for the younger generation. Ask Gildor for help and you will be told that the computer doesn't know "for". Ask Gildor to help and the computer is sorry, but it doesn't know how to do that. Of course it lets you talk to Gildor but you never get to know what the conversation was about. It doesn't know the word "listen" and a really good wheeze is typing in "Hear Gildor". This generates some of the most spectacular rubbish I have ever seen a computer utter. Good fun for adventure freaks.

THE LAST V-8

▶CBM-64 ● Mastertronics M.A.D ● Arcade Driving ● £2.99 ● Paul Bond

SCREENS

● The Last V-8: Excellent value for money.



"V-8, return to base". The computer issues this order in suitably stentorian tones at the beginning of the game — you only have a limited amount of time to get your souped-up, post-holocaust runabout back in the garage before the radiation gets you. The screen display is an areial scrolling view of the terrain. This is a race against time as opposed to a race against another car, but like most racing games you have to remember to take the curves slowly and you have to get to know the route.

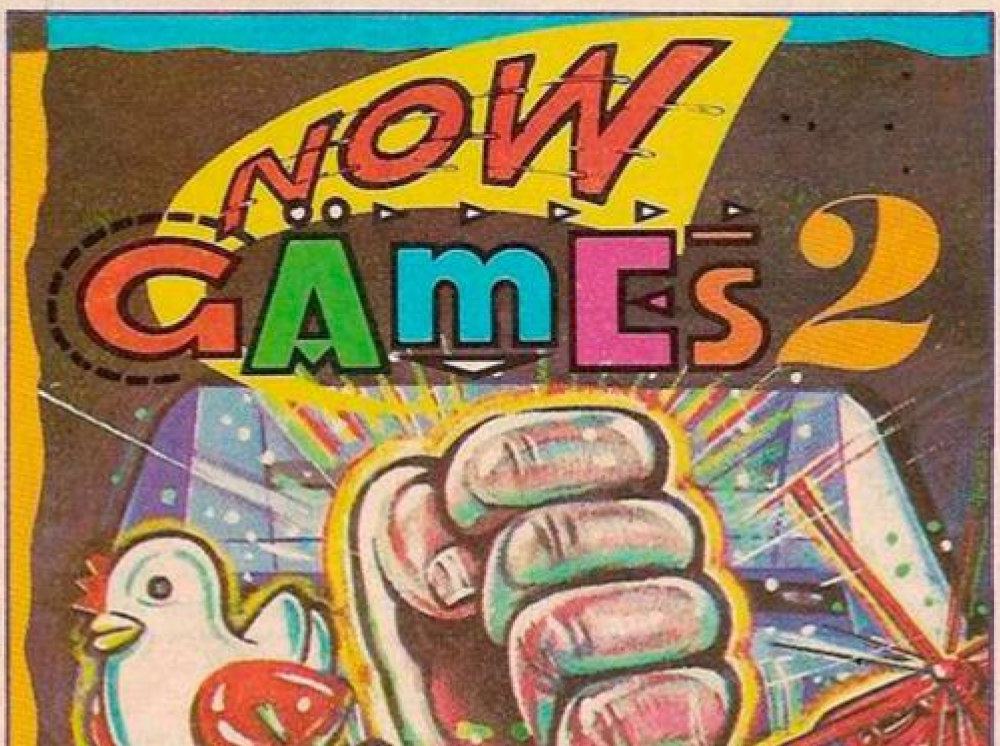
Created by David Darling, the game has incessant synthesised music, smooth-scrolling graphics, and, in short, all the hallmarks of a much more expensive game. Value for money it definitely is, which is the purpose of the Mastertronics Advanced Design range — and still well within the range of the average pocket-money customer. Surely one of this company's best defences against piracy is price — which is not to say that their games don't get pirated.

It's tough and will require what little co-ordination you have left to get yourself into the city.

Five Fantastic Games

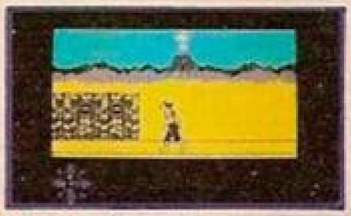
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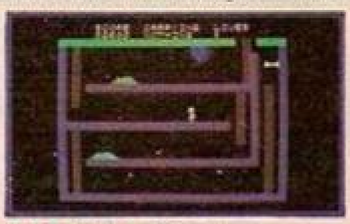
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3. CAULDRON – Palace Software
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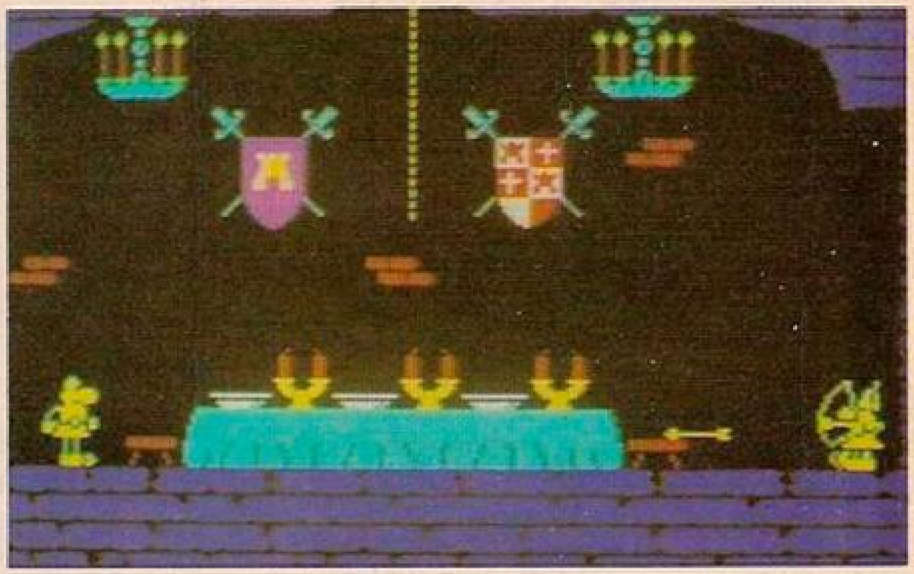
SIR FRED

▶Spectrum ● Mikro-Gen ● Arcade adventure ● Lee Paddon

GRAPHICS ●●●●
SOUND ●●
PLAYABILITY ●●●
VALUE FOR MONEY ●●●●
OVERALL RATING ●●●●

SCREENS

● Sir Fred: Takes the arcade adventure to new heights.



With Rambos mowing down everything in sight and Supermen juggling skyscrapers, this offering represents a return to Elizabethan values. The gallant Sir Fred has to rescue a princess from a castle. Glossing over the sexism endemic in computer games — when has a princess ever done any rescuing? — this is another from the ever popular arcade adventure genre.

All the rooms you can eat, with nasty things trying to drain your strength, lots of objects to pick up, and then work out what to do with.

It's a tricky game to master, one for the real aficionados to drool over. If you thought Jet Set Willy was a piece of cake, then this could be right down your dungeon.

Despite only the usual controls of up, down, left right, select and use, a lot of extra moves have been crammed in by combinations of the keys. Climbing, running, swimming, there is apparently no end to his talents.

The graphics are up to Wally standards, despite the fact that it was written by a Spanish company, rather than the Wally programmers. Another of Sir Fred's many talents is swinging on ropes. However, this is where the game rather falls down — or at least I did.

You are meant to swing on the rope by pressing alternately left and right; I must have been defeated by keybounce or something, but all that kept happening is the intrepid knight would end up going spurs over helm.

Just to cater to the mobs of computer games players conditioned to handing out mindless violence to all who get in their way, you get scoundrels and footpads to put to the sword. This rather goes against the grain of normal arcade adventures where the philosophy is to avoid things rather than kill them.

Odious overtones apart, this game takes the arcade adventure to new heights.

ELITE

▶Spectrum ● Firebird ● Shoot'em-up ● £14.94 ● Lee Paddon

GRAPHICS ●●●●●
SOUND ●●●
PLAYABILITY ●●●●
VALUE FOR MONEY ●●●●●
OVERALL RATING ●●●●●

A year after the battlestar Elite was launched, it has at last made contact with the universe of the Spectrum owner. Perhaps the most talked about computer game ever, has it lost anything in translation?

The game has virtually been rewritten by Firebird's Torus team, and is a very impressive piece of programming. All the best features of the BBC game are there — very fast vector graphics, good instrument display and of course temendous depth.

You start off as "Harmless" with a real bucket of a ship and 100Cr to your name. Your ambition is to attain the fabled combat status of "Elite", and line your pockets at the same time. The game starts slowly while you get the hang of the controls and make a paltry profit shuttling between safe planets, then the pace begins to quicken as you fill you hold with highly profitable cargo, and equip your ship to allow you to go where no man has traded before.

To attain the status of Elite you have to blow away some 8,000 ships. To break up this somewhat monotonous process, you are called upon to perform a couple of missions for the Galactic Navy.

What, of course, sets this game apart is the use of vector graphics and challenging combat sequences with, if you're unlucky, up to a dozen ships and general bits of debris floating around the place. The number of ships is a reflection of your legal and combat status, the type of planet and your cargo.

Shooting peaceful traders and trading in narcotics are good ways to get rich quick, but the police take a dim view of it. Things can soon get sticky with half a dozen ships whittling down you energy as you twist and turn trying to escape. However, once you're equipped with a military laser — affectionately known as The Can Opener by pilots everywhere — life becomes a little easier. If it really gets nasty, it's time to hyperspace out, or perhaps try out the smart bomb.

Although it's difficult at this early stage to tell whether Firebird have succeeded in bug eradication, there does seem to be a problem with the space stations which are sometimes placed too far away from the planet, and on one occasion in the middle of the planet.

On the plus side, your status is contantly displayed on all screens and the display is very fast, even when a lot is happening on the screen.

Frankly a program no self-respecting Spectrum owner can afford to be without.

WILLOW PATTERN

▶ CBM-64 • Firebird • Graphic adventure • £3.95 • Toby Wolpe

GRAPHICS
●●●
SOUND
●●●
PLAYABILITY
●●●●
VALUE FOR MONEY
●●●●
OVERALL RATING
●●●

SCREENS

• Willow pattern. An adventure on a plate

Everyone knows about the game-of-the-book, game-of-the-film, game-of-the-teeshirt syndrome. But this must be the first game to be based on a blue-and-white tea service.

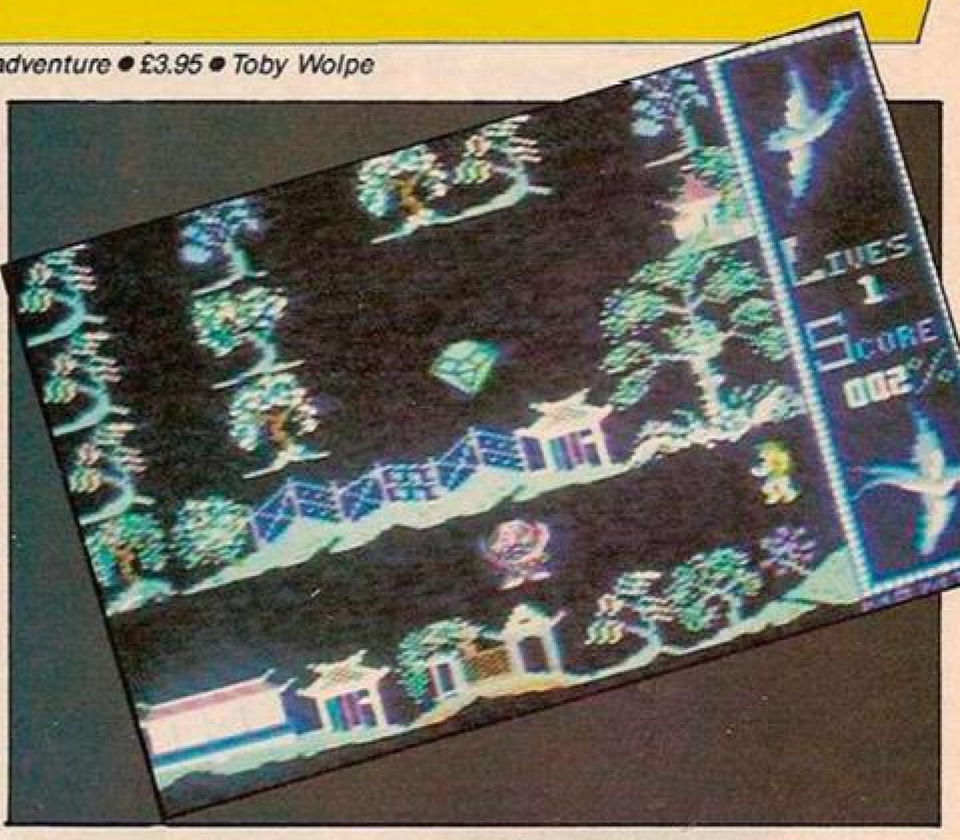
All those fond of Chinese food will be pleased to know that if you manage to save Princess Koong-Shee you'll be chased out of the maze by her father, that well-known oriental dessert Li Chi. Let's try forgetting food for a minute — which is difficult given that Firebird is the first company to hand you an adventure on a plate.

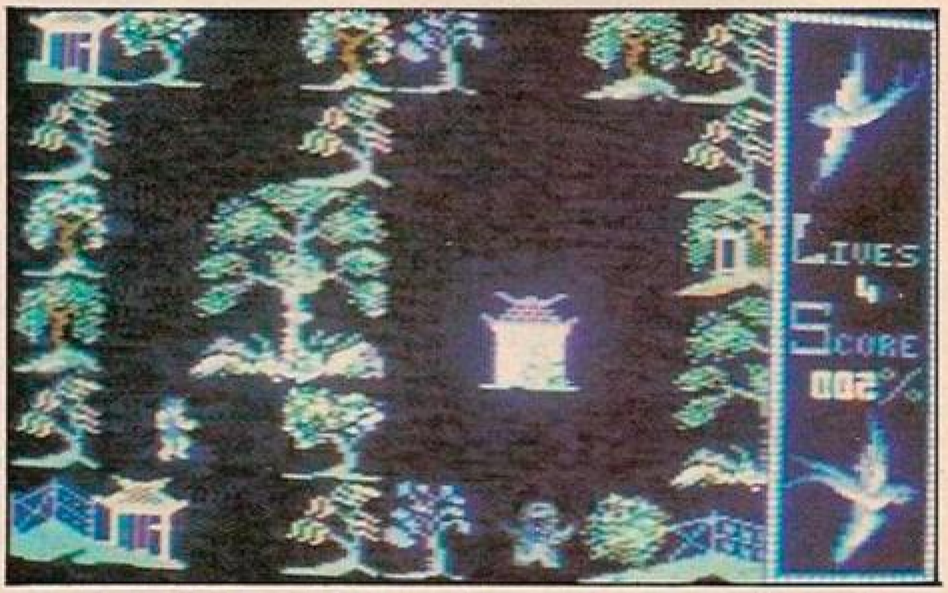
Apart from the setting, there's nothing terribly original about the Willow Pattern plot. You have to guide the hero, Chang, around a maze of suitably Far Eastern complexity. His aim is to gather items on route — the most important one is the key — which will help free the Princess.

Although the game view and playing techniques resemble Sabre Wolf, there are none of those tiresome nasties which litter Ultimate games. In their place you'll find maze guardians at key points. These touchy warriors can only be passed if you have a sword to hurl at them.

Some of these Chinese bouncers stand there impassively blocking your path, others fling swords which you can dodge, pick up and use to hack down their former owners with.

An important tip is never to use words unnecessarily. If you do, you'll find it impossible to get past certain guards later on. It's not even worth collecting a sword until you're sure what to use it for.





A nice touch is the way the tempo of the Chinese take-away music picks up when you're holding a sword.

Of course Willow Pattern wouldn't be Willow Pattern without those little wooden bridges. But if you try to cross one you find yourself in a different playing sequence that doesn't seem to match the rest of the game. As Chang hops across the stepping stones under the bridge a pack of giants try scooping him.

The smooth graphics and tinkling music are very good given Willow Pattern's £4 price tag. The maze is just right, too.

SPEECH

▶ BBC • Superior Software • Utility • £9.95 • Simon Beesley

VALUE FOR MONEY
●●●●
OVERALL RATING
●●●●

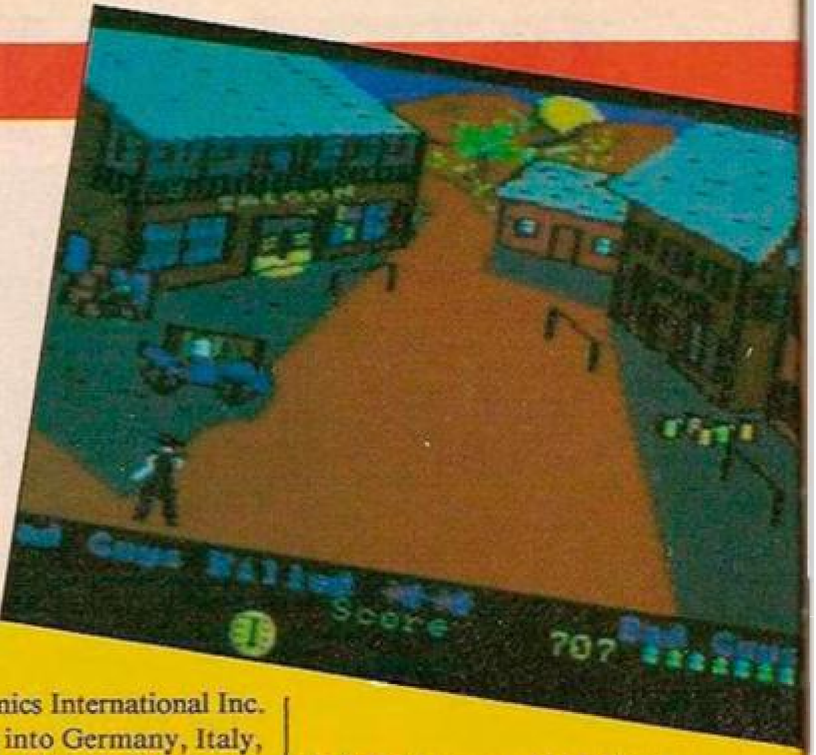
Speech without a speech chip. It's hard to think of a more entertaining utility than this one. You can easily insert the program's 7K of code on someone else's disc, write a short Basic loader, and ask them to boot it up. Lo! a spoken message. The surprise effect alone is worth the price; like seeing colour on a ZX-81 screen.

Speech's speech may not always be intelligible if the words are not printed on the screen at the same time. But it is unusually easy to use. *SAY voices any English sentence, while *PITCH sets the pitch. If you are willing to put a bit of effort into it you can improve the program's enunciation by using *SPEAK which directly accesses a set of 49 phonemes. One of the demo programs will even take a text file — from Wordwise, or View, for example — and painstakingly talk it through — if you can bear to listen to it.

Although speech has been generated before on the CBM-64 and Spectrum, through the sound chip alone, this is the first time on the BBC. Elsewhere in this issue Speech's author, David Hoskins, explains how.



Master Pieces



April 1984. It began quietly, insidiously. Rumours about cheap software — "pocket-money games". The establishment scoffed. It couldn't be done — look at the overheads; paying distributors, duplicators, artwork and advertising costs — sometimes even the programmers wanted a cut. Anyway the product would be cheap and nasty and would blemish the noble escutcheon of the British games software industry — which apparently, was so altruistic it made Dr Barnado look like Richard Branson.

"Companies that said Mastertronics were bad for the industry have gone. They're not around and we are," points out John Maxwell who selects the programs for the company stable. "Activision, Ocean, Melbourne House — those kind of companies are all far too professional, far too good to worry about the penetration of other people into the market place."

Mastertronics is more than the sum of its parts. John Maxwell heads Artificial Intelligence Products which deals with the raw programs, Colin Johnson is Dream Promotions which handles Mastertronics' artwork and promotions — and Mastertronics itself is represented by Martin Alper, managing director responsible for the American side of the business and matters other than the UK sales, production and distribution handled by UK sales director Alan Sharham.

Martin Alper, already comfortably ensconced in the video business, effectively founded Mastertronics when he bought a tape and data duplicating facility. "I asked the guy how much it cost to duplicate a tape — he said about 30p; then I asked him how much they sold the games for — about eight or nine pounds. I couldn't understand the massive difference, so I took a closer look."

Savings in volume is the keynote of Mastertronics philosophy — to be profitable Colin Johnson says their games must outsell competitors at a ratio of 4 to 1. "But, for example, in Boots we are selling at a ratio of about six or seven to one, so we are outperforming considerably."

How did little acorns Mastertronics manage to grow into a mighty oak dominating a mammoth 18.47 per cent of the entertainment software market (according to Gallup)? "We went over the heads of the distributors," says Martin Alper. Websters, Terry Blood, Centasoft — none of these firms would have touched the burgeoning company with a barge-pole. But Martin Alper had his own sales force: "We already had about 18 or 20 salesmen; we just hired another 12. Within 14 days of launch we hand the product in WH Smiths — then the distributors had to sit up and take notice.

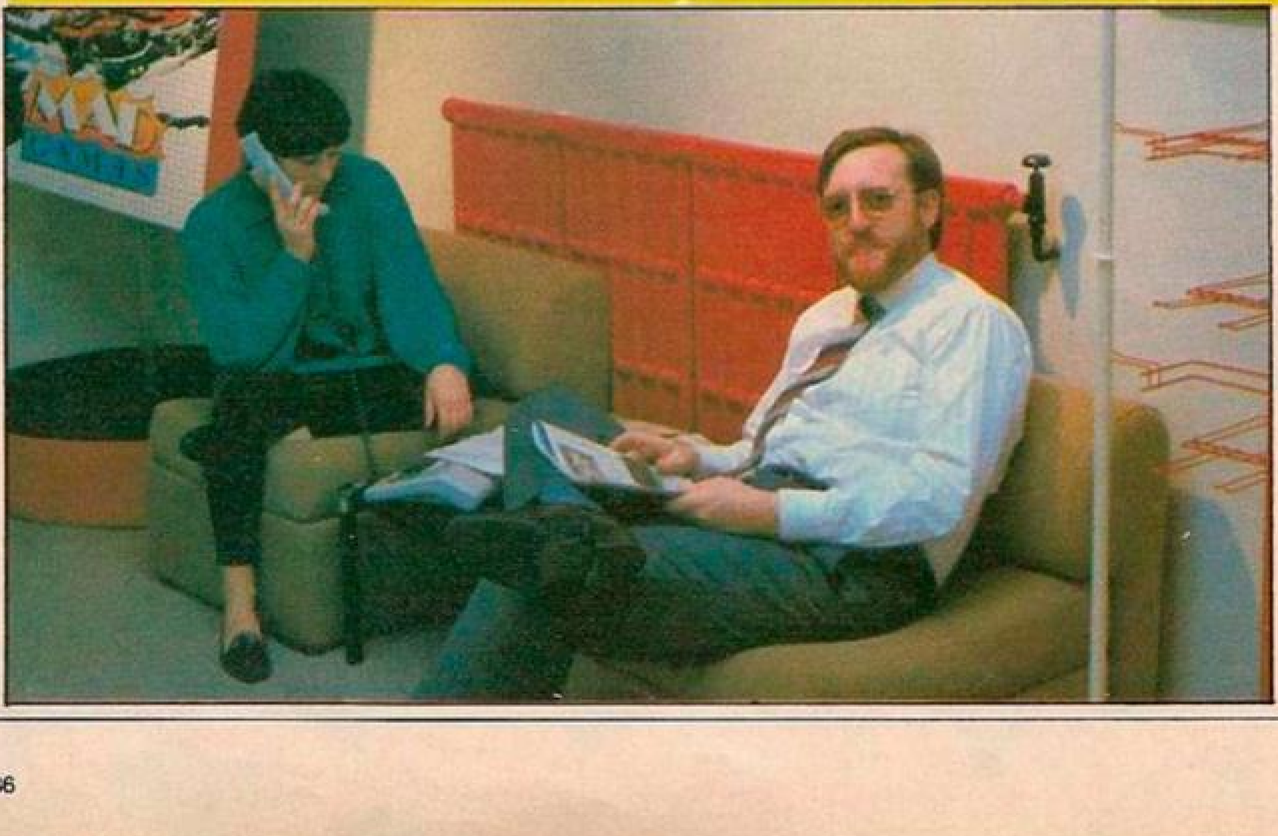
Shuttlesoft is the firm's marketing arm responsible for getting all those cassettes into your local corner-shop. This is the basis for Mastertronics GmbH, Mastertronics SAS, Mastertronics PVBA and Mastertronics International Inc. All selling into Germany, Italy, Belgium and the United States.

But is it quantity rather than quality? "At the start we certainly went for bulk", agrees John Maxwell. "We wanted to build up a team of people we could rely on. We get about 200 games sent in every month. We look at everything — if there's a spark of something we contact that person. A good machine-code programmer is not your average run-of-the-mill person. They're very serious, thirsting after knowledge all the time.

"We estimate that there are as few as 100 really top-class machine-code programmers in the country. We also believe in religious payment of royalities — a lot of our programmers were surprised when they got paid promptly, which in turn surprised us. We didn't realise how badly some quite big companies behaved."

David Darling, who wrote one of Mastertronics all-time hits, Chiller, learnt to program with his brother Richard while living in the USA. Mastertronics believe in encouraging talent — hence David Darling's promotion to the new MAD range, priced at £2.99 as opposed to the standard £1.99 range. But Chiller, successful though it is, had some problems — namely its Michael Jackson *Thriller* sound-alike soundtrack. Rocksoft, a company set up to protect royalties of musicians, took Mastertronics to court. "A very clever girl wrote down the music of both Chiller and Thriller, and proved that they were not identical. But the barrister said it would cost us £60,000 to prove we were in the right. It was cheaper for us to settle out of court", said John Maxwell. "Rocksoft is no longer functioning, I believe."

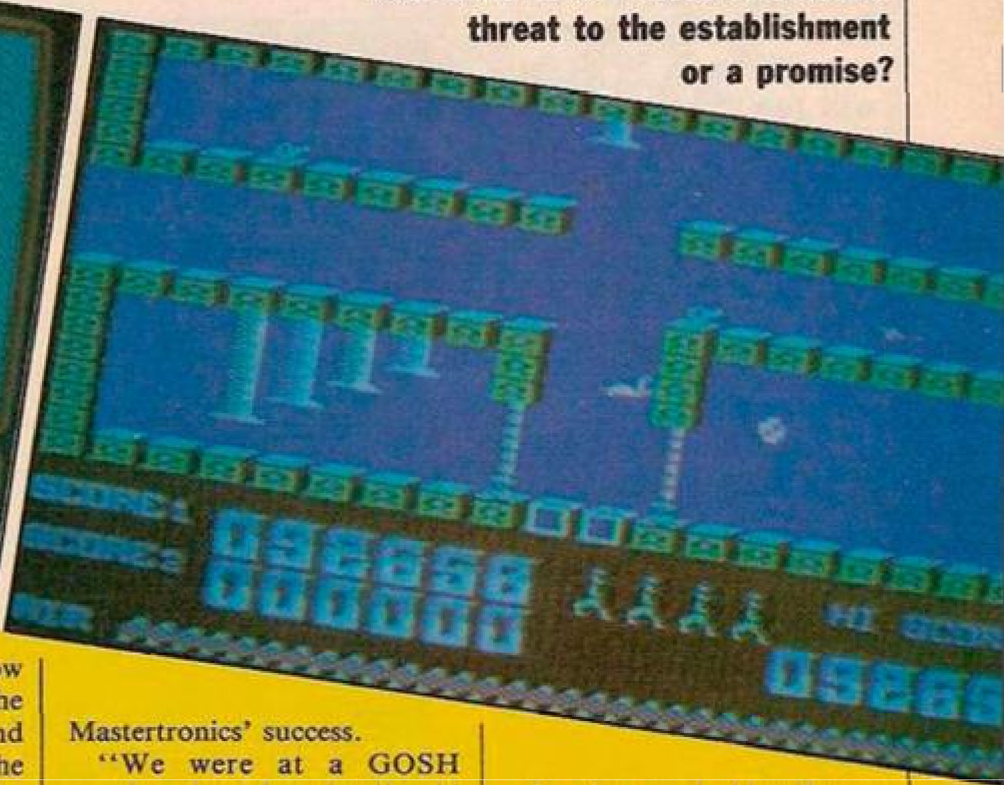
But David Darling is, and his new program, The Last V-8 with synthesised speech and super-smooth scrolling graphics adds a touch of Mad Max to the MAD (yes, it stands for Mastertronics Advanced Design) range. Set in 2008, just after a nuclear war you have to



Paul Bond meets Mastertronics: a threat to the establishment or a promise?







Top left: Kane. Above: One Man and his Droid; Top Right: Big Mac. Below left: Colin Johnson, Alison Beasley and, below right: Spellbound.

return to base before disaster overwhelms you — see Software Shortlist for full review. Along with Sean "Kikstart" Southern's Hero of the Golden Talisman, an all-action arcade advanture, and David "Finders Keepers" Jones, The Last V-8 forms part of a three pronged assault on the quality end of the market. "It also means we can pay the programmers a bit more", John Maxwell is keen to emphasise.

How far up-market will Mastertronics go? They are very proud of their acquisition of Ski-Writer an extremely user-friendly word-processing program developed by Ken Skier for Wang in the United States. Marketed over there for about $69 by Prentice-Hall, Mastertronics have acquired rights to Apple and CBM versions. It will be sold here for the CBM-64 at £13.95 (Cassette) and £14.95 (disc).

Part of the secret is to put all the help functions into the program itself, rather than a bulky accompanying manual — this cuts costs and provides a utility at considerably less cost than Commodore's home-grown word processor — it might stop a lot of 64 owner trading their micro in for an Amstrad PCW. You can get the equivalent of 22,000 characters into the Editor before downloading.

But fear not — Mastertronics will not desert their zap-pow roots. Recent releases for the CBM-64 include Kane and Zzzz, plus Specventure for the Spectrum and Big Mac for the C-16? According to a recent Gallup survey it's Britain's fourth biggest selling machine after the Spectrum, C-64 and Amstrad machines. "And there's not much software for it," says John Maxwell. Like everything the company have done from day one, this exemplifies the secret of Mastertronics' success.

"We were at a GOSH meeting the other day," said Colin Johnson. A man for a software house stood up and asked the WH Smith's representative why they had dropped his company's entire range. The rep replied that he had just explained that Smith's no longe carried BBC/Electron software — which was all this guy's company did."

In other words, identify your market. "Yes — Mastertronics always assumed there was a market for high-playability impulse-purchase games with a short life-cycle. Even if kids bought one every two weeks, they would still take two months to spend the same amount of money that they would spend on a full-price game." ●



Hewson

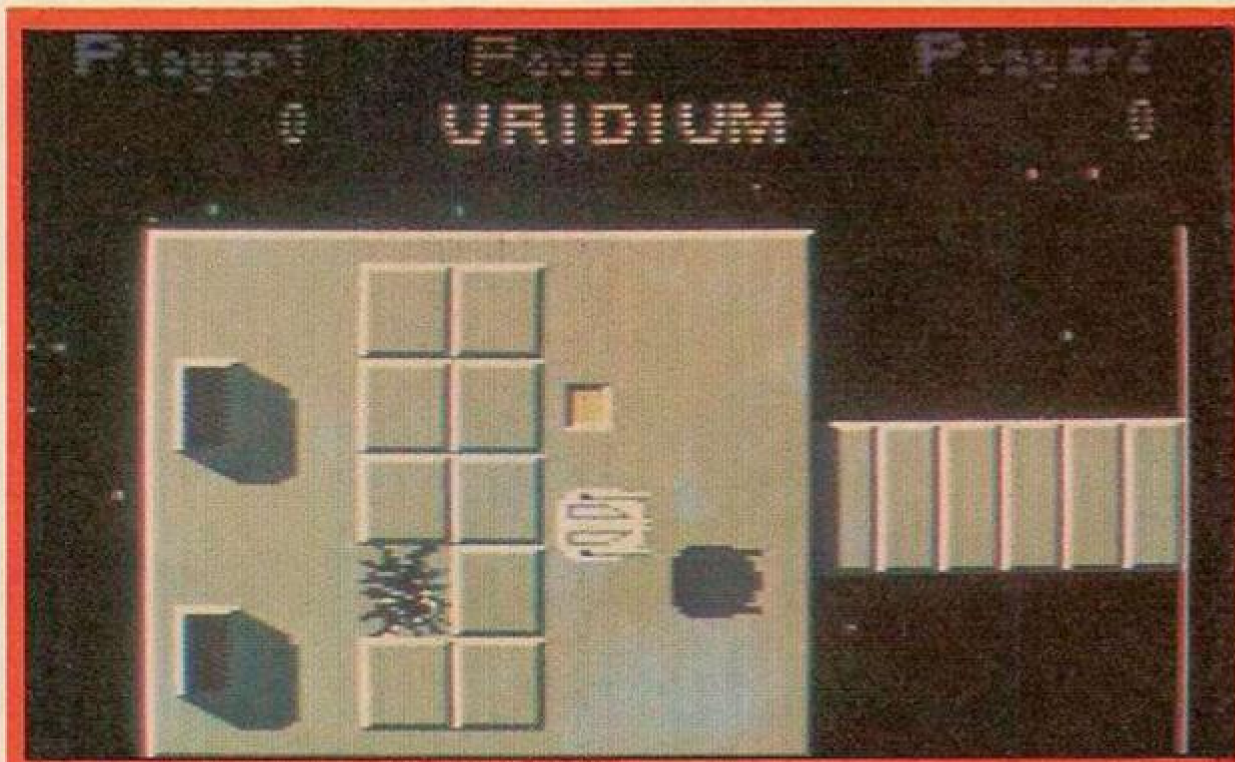
If you thrilled to Paradroid, Hewson's new stunner, Uridium, will really knock your socks off. Paul Bond reveals all.

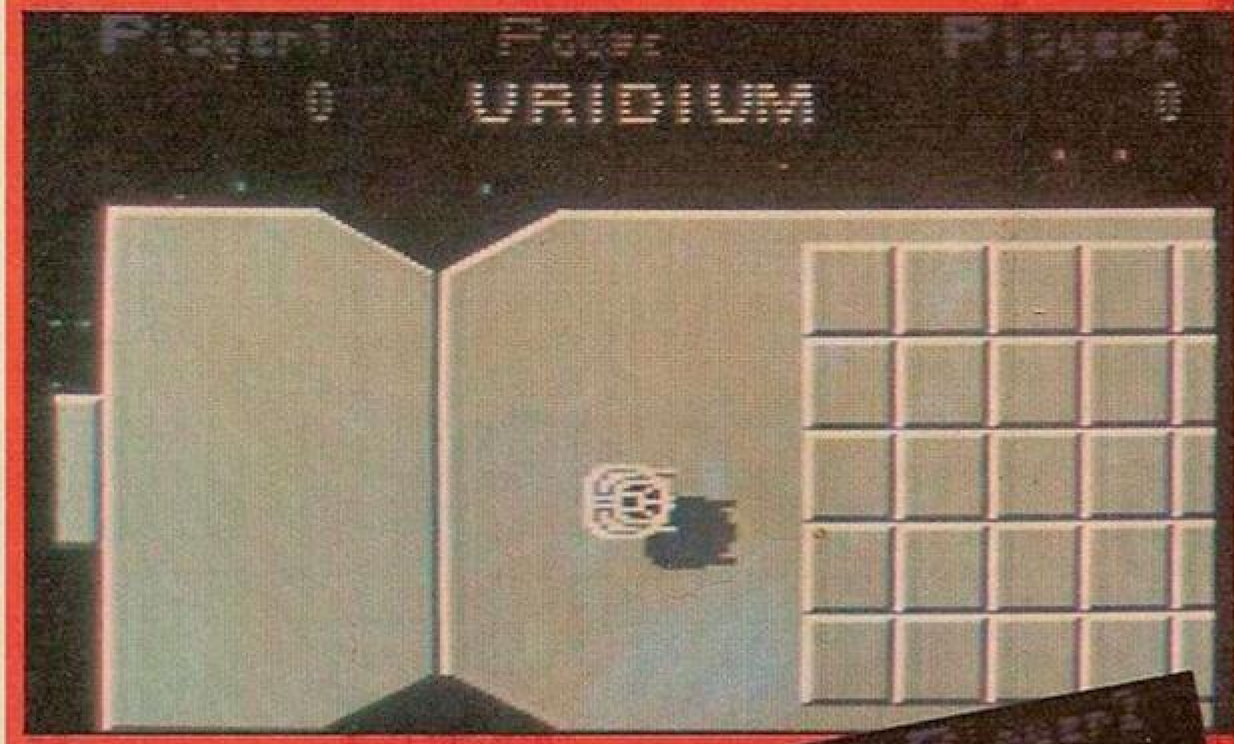
Just when you thought it was safe to go back into outer space, hard on the heels of Hewson's Paradroid comes Uridium — another Andrew Braybrook masterpiece. With the same hard-edged three dimensional graphics that make your 64 look like an arcade machine and some brain-twisting sequences this game stands apart from the run-of-the-mill shoot'em-up.

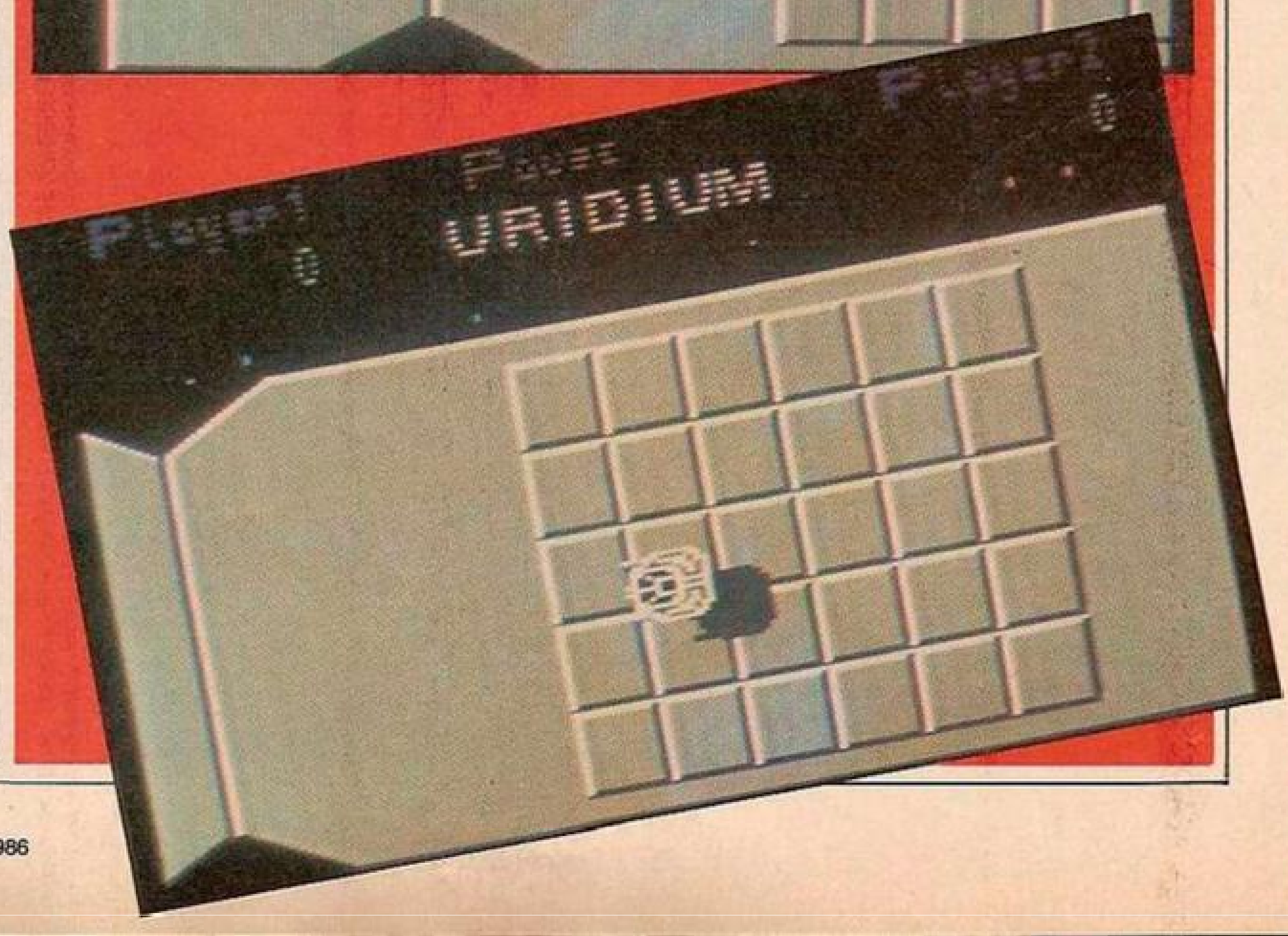
The pictures here show the program under development — you pilot a small spacefighter attacking a gigantic armed starship. You craft can spin, wheel and loop the loop — during all these manoeuvres its shadow is faithfully etched on the space leviathan beneath you by the harsh unscintillating light of the local star.

Naturally you must incapacitate the on-board defence systems of the ship — turrets, but also its own on-board defence squadron, scrambled from exterior launch-tracks on the outer hull — still under development at the time these pictures were taken. The attacking craft will have the same realistic movement as your own scoutship, but will attack in waves composed of up to six vehicles flying in formation, peeling off one by one as they attempt to rupture the fragile shell that separates you from the airless depths of the cosmos.

As in Paradroid, there will be more than one ship, Uridium being the name of the final craft that you must destroy. Andrew Braybrook is toying with the idea of a hyperspace transfer sequence that will echo the mind-control section in Paradroid. The program is scheduled for release before Easter but Hewson are cagey about making promises that they may not be able to meet. A lot of us are still waiting for Novagen's Mercenary at the time of going to press.







There's life beyond games. Simon Beesley settles down to some serious software reviewing.

A popular misconception about home computers says that they are not really suitable for running business software. If you are starting from scratch, people advise you to buy a 16-bit micro. This means buying an IBM PC or one of the legion of IBM comptibles.

In point of fact, now is a very good time for 8-bit business software. Amsoft has started to release CP/M classics such as Supercalc at a fraction of the price they were selling at two years ago — £50 as compared to £200; while Computer Concepts has launched the first two of four integrated business programs for the BBC. Called Rom-link, this package will be the first serious application of the integrated software concept to home micros.

To run business software a home computer needs to meet at least three requirements: it must have a decent keyboard, an 80-column screen mode and, of course, an adequate range of software. These conditions rule out all but the CP/M based micros — Amstrad, Memotech, Tatung Einstein, and Enterprise — and the BBC.

Software on Rom

You can run CP/M software on the BBC by adding a second processor; but its main asset is the range of programs on Rom. Despite being limited to 16K, BBC Rom programs are often just as effective as their larger CP/M counterparts. This review looks at business software in general, and the BBC variety in particular.

Leaving aside specialist programs such as accounting packages, business software falls into three categories: wordprocessors, spreadsheets, and databases. Business software, however, is perhaps a misleading term. It suggests that you actually need to be involved in running a small business to make use of them.

In fact, wordprocessing programs have a much wider appeal. The beauty of a wordprocessor is that it allows anyone to produce a professional-looking document without being a competent typist. Take the problem of typing a letter designed to impress, say, a bank manager or a prospective employer. Unless you are a trained secretary, to do it properly usually means an exercise in frustration, resulting in a bin full of crumpled writing paper.

With a wordprocessor even one-finger typists can produce Tipex-free letters remarkably quickly. Just as important, they can also lay them out correctly.

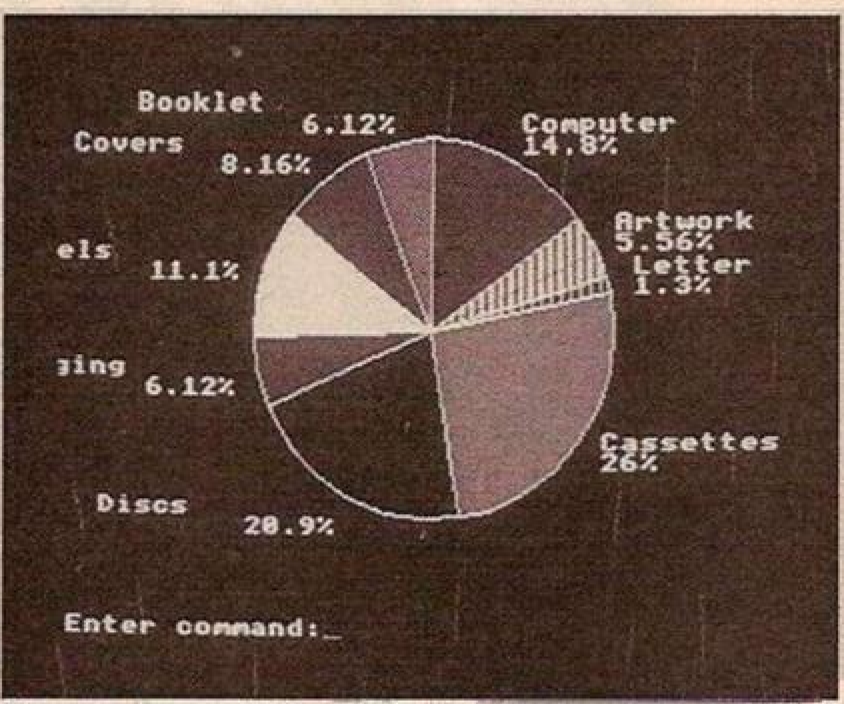
On the BBC, Computer Concepts' Wordwise and Acornsoft's View illustrate two different ways of entering text. View displays a document exactly as it will appear when printed out. If you want to enter text over more than 80 columns the screen can be scrolled sideways.

By contrast, Wordwise only allows text to be entered in 40 column mode. To format a document you insert sequences of command characters. There is a preview mode which allows you to see how the text will look after formatting. However, laying out tables over a number of columns can be a fiddly business.

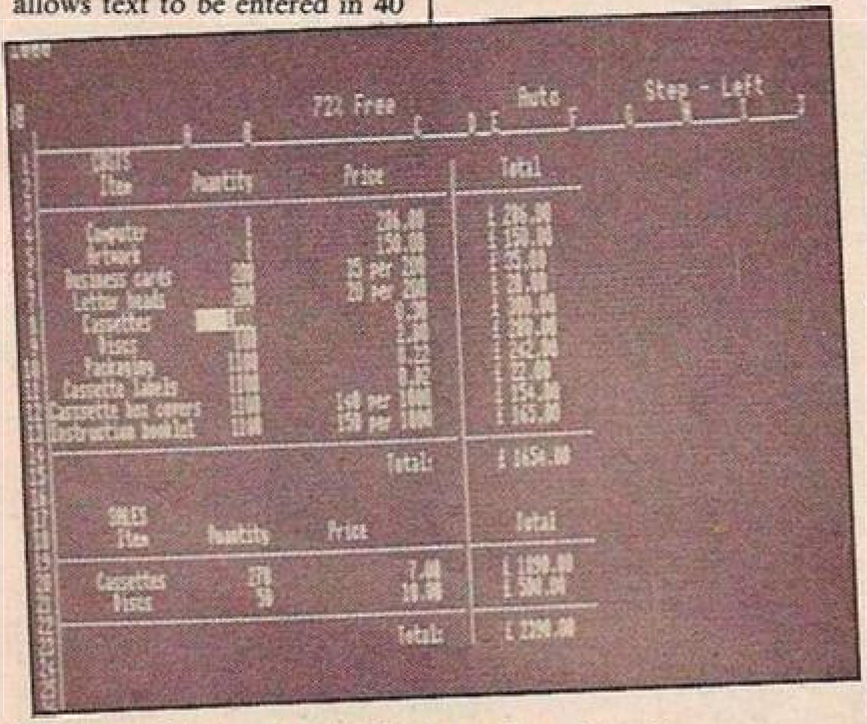
What gives Wordwise a decisive edge over View is the inclusion of a programming language, similar to Basic, with 70 commands. When you consider that CBM-64 Basic has no more than 70 commands, you will realise what a powerful feature this is. Among other things, it allows you to instruct the computer to print out a document as many times as you want; or run a mail merge; or produce a page index.

Both View and Wordwise can hold their own against larger CP/M programs such as Wordstar. And because they have been written specifically for the BBC they are much faster. To shift text on the screen CP/M programs have to work through a layer of operating system routines. This makes them noticeably slower in scrolling or reformatting a document.

Speed is also a feature of Computer Concepts' new spreadsheet program for the BBC, Inter-Sheet. Not only is it much faster than Supercalc II on the Amstrad, it also outstrips most spreadsheets for 16-bit micros. Supercalc II, on the other hand, has a greater range of commands and options.



Computer Concepts' Interchart solves the integration problem.



Computer Concepts' spreadsheet on Rom, Intersheet.

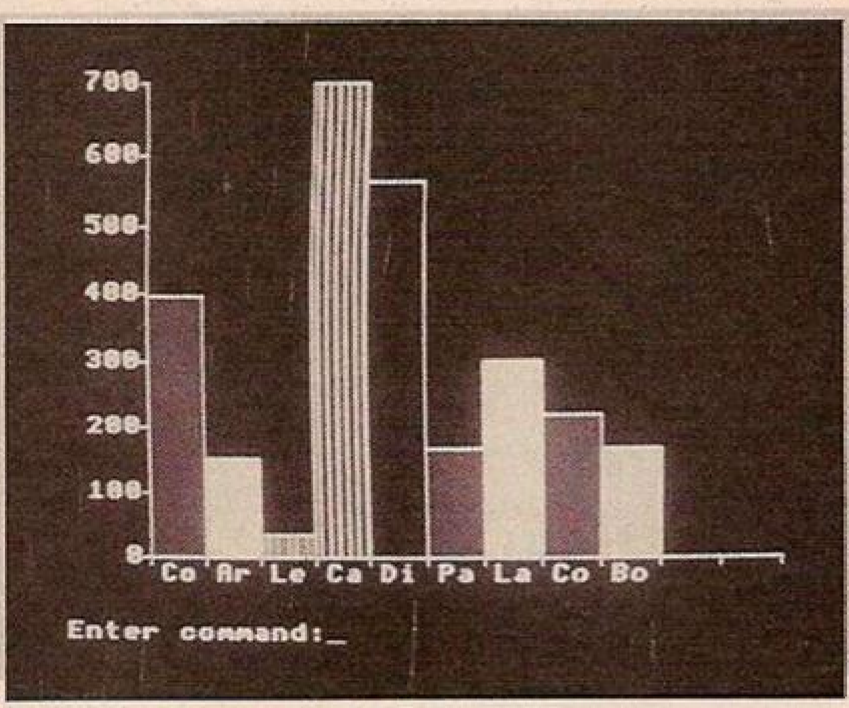
For an idea of what a spreadsheet does, take a look at the Spectrum version in this issue. Put simply, it provides a grid on which you can manipulate figures as easily as a wordprocessor handles words. Each cell or box in the grid can hold either a figure, or a formula calculating a result from any other figures in the grid, or a label.

For example, you could lay out a balance sheet with Costs down rows 1 to 8 in column A, and Sales down rows 1 to 5 in column F. Working out the total profit or loss is just a matter of entering in a cell below, the formula, SUM(F1:F5) — SUM(A1:A8). If you now want to change a figure or insert a new item, you can do so almost immediately, and get a result almost immediately.

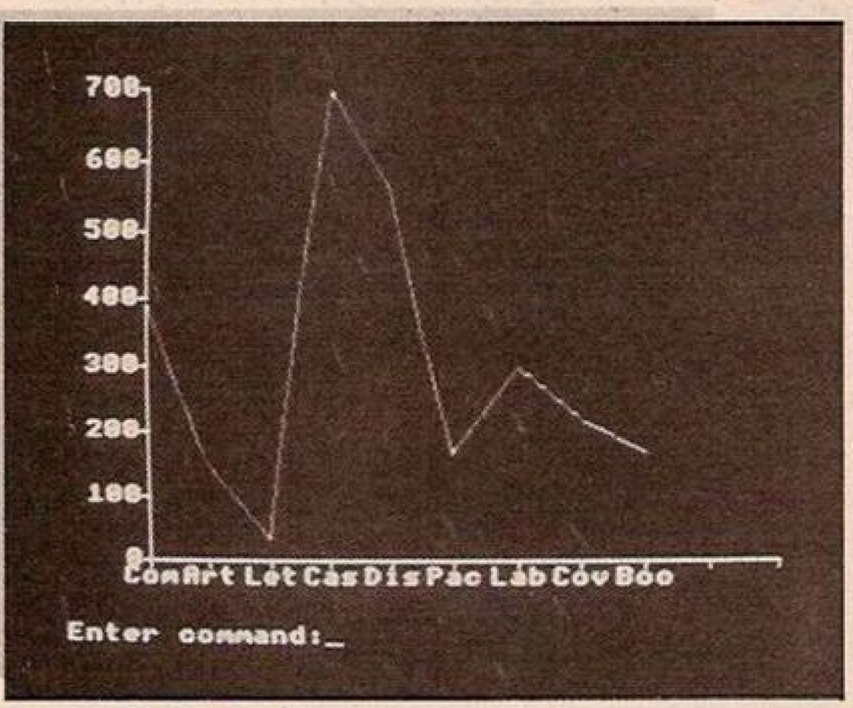
Complex or simple?

Obviously spreadsheets lend themselves to far more complex applications than this example. Yet the principle remains the same, even with elaborate financial models which relate hundreds of cells via complex formulae: calculating a result, after you have re-adjusted figures or changed a formula, takes no more than a few seconds.

Again, you do not need to be involved in business, to find a spreadsheet program useful. Both Supercalc II and Inter-Sheet are equally suitable for sophisticated financial planning or tightening up your household



Spreadsheet data presented in a bar chart.



Interchart's line graph option.

budget.

It is less easy to make the same claims for database software. A database is simply a computerised filing system. Files are usually organised as a collection of records, which in turn break down into fields. Thus, a single record might hold a name, address and telephone number in separate fields.

For many purposes a database program is more trouble than it is worth. Why store your friends' telephone numbers on a computer when you can look them up more quickly in an address book?

In the *Your Computer* office we still use old technology in the form of filing cabinets. The business of typing into a computer files containing product and company information, contributors' addresses, and so on, would be too time consuming.

Where databases come into their own is in their ability to sort and select data. Recently we had to prepare a list of all the games titles currently available for home micros, for Your Computer's Top 100. Together with each game we wanted to give the machines it ran on, and the company name. And we wanted the list sorted into alphabetical order. At a rough estimate we thought the task would require a file of over 100K; far larger, in fact, than the memory capacity of most home computers.

Acornsoft's ViewStore, which comes on a 16K Rom, was the database we chose. It is one of the few programs that gives you an almost unlimited file size — Starbase from GCC Ltd is another, for the BBC. This it does by treating the disc as "virtual memory", in other words as an extension to Ram. The maximum size of a file is nearly 2 megabytes.

As a consequence the program needs to be continually accessing the disc, and slows down considerably when you add a record to a large file. But by comparison with other home micro databases ViewStore is exceptionally powerful. Among other things, it provides extensive facilities for indexing data, reformating it, and selecting data to create new files or to generate reports. Especially useful is its utility for printing labels from a mailing list.

The major drawback to ViewStore is that it is not easy to use. It took us 15 minutes to discover how to print out our list; and another 15 minutes to prepare the file for printing. Part of the blame can be ascribed to the manual, but, to be fair, the more sophisticated the program, the harder it is to master. A reviewer recently complained that it was months before he could find his way round Psion's integrated software package, Xchange.

For 16-bits only

Psion's program only runs on 16-bit micros, costs over £500, and calls for at least 256K Ram. Lotus' Symphony — a development of the first best-selling integrated program, Lotus 123 — needs 512K, and costs over £600. Naturally, these packages are far more extensive than anything you are likely to find on a home computer.

The idea behind integrated software is that different programs can use the same data. To some extent you can do this anyway with programs like Wordwise and View, by spooling files so that characters are stored as Ascii codes. In this way it is possible to edit Basic programs or exchange files between Wordwise and View. But it does not allow quite different types of software to share the same data. Typically, an integrated package includes a wordprocessor, spreadsheet, and database, each of which can work on the same files.

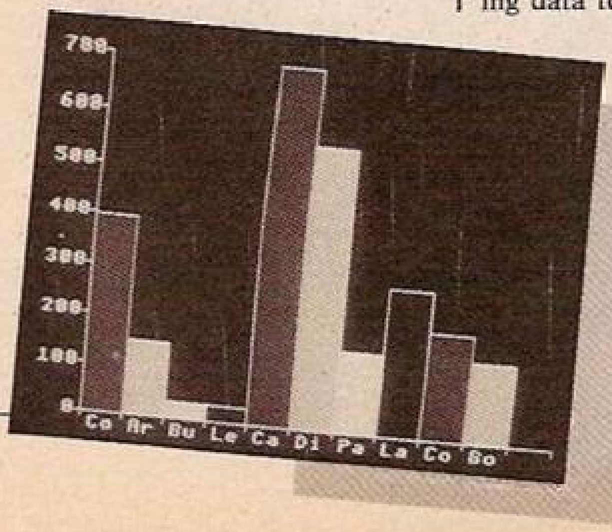
Integration is also taken to mean having the various programs resident in the computer at the same time. Lack of memory is the main bar to including this last feature on a home computer. But this is just what Computer Concepts has done with its Rom-Link series.

You can create a spreadsheet on Inter-Sheet, then switch in Inter-Chart — by typing *ICHART — and see your figures displayed on a bar chart with the labels beneath them. Inter-Chart is a chart and graph plotting program, so you can equally well display the spreadsheet file as a pie chart or a line graph.

Impressive solution

Computer Concepts' ingenious and impressive solution to the integration problem takes advantage of the BBC's sideways Rom facility, whereby the machine can accommodate up to 16 Roms at the same time. The other Rom-Link programs will be Inter-Base, a database program with a built-in programming language, and Inter-Word, an 80 and 105 column wordprocessor.

When Computer Concepts releases these two products early next year, you will be able to plug in — to a Rom extension board — a bank of Roms, all instantly available, and all perfectly integrated.



More business graphics from Interchart.

KNIGHT-CLUBBING

Ian Adamson, Richard Kennedy and Freda Trovato do some Sinclair research.

How and why did Sir Clive Sinclair come to acquire his current high-profile reputation as "inventor", "innovator", "visionary" and general balding boffin around town? What we have found has changed our view of Clive in many ways. We've uncovered a consistent history as a sort of technological barrow-boy, a provider of technical toys he thinks the public should want. Sometimes they do — ZX-81 and Spectrum — and sometimes they don't — C5 and Microvision.

The book we have just finished, uncle Clive — Soul of the Sinclair Machine — investigates the corporate career of Sir Clive Sinclair. This ranges further afield than the home computing area in which millions have come to know of "Uncle" Clive.

From the start, back in 1962, Clive has combined minimum component cost and mail-order merchandising. Full-scale advertising campaigns bring the money flooding in from the punters to pay your bills before you've sent anything out.

This practice of "forward financing" has stuck as a bit of a habit with our Clive, as many readers will know. Then as now some ads attracted complaints because of unjustified claims, and products were rushed into production quickly, with resulting design and quality-control problems. Demand exceeding supply became a familiar phrase used to justify delays. Sound familiar?

Mostly the hobbyists didn't complain too much, just as the computer consumers and computer press nowadays are far too willing to forgive and forget commercial and marketing tactics from Sinclair that demonstrate an unfortunate lack of professionalism and an indifference verging on contempt for the consumers who provide the profits.

Get rich quick

Clive's computers, with the possible exception of the ZX-81 — which did provide genuine cheap computer power if you could stop your Ram pack dumping the program and if it didn't give up through overheating — have hardly served the cause of computing, if this is understood as pressing processing power into service to perform functional tasks.

They *have* served to enrich Clive, and make him into a household name. They have also given us the computer games industry, for all the good that will do mankind, by providing the cheapest available means of playing poor imitations of arcade games on a flickering and colour-crawling TV screen, but not much else.





Sir Clive poses with two of his most far-out brainchildren; in deep prayer before the C-5 Juggernaut, and left, the QL monolith. Innovations or high-tech toys

The avuncular Uncle Clive, posing as some sort of Ronald MacDonald of information technology, with his cheap keyboards, minimal components, impotent speakers and quirky Basics has in fact served the cause of consumer electronics alone, which is the art of providing technological gimmickry at a low enough cost so you can grab the innovative toy and gadgeteer market.

The success of the Spectrum is a creation of, and is still sustained by, the software rather than the minimal, but high profit-margin, hardware.

Sinclair Research was set up as Clive's lifeboat from the sinking ship of his first company, Sinclair Radionics, when the NEB took over control. It produced the MK14, a microprocessor trainer kit using the National Semiconductor SC/MP or Scamp chip. It was, relatively speaking, a great success, and confirmed the computer market potential.

Although the official history has it that Clive left Radionics and then started to work on the ZX-80, this obscures the truth of the matter. Since work had started in April on the Basic for the ZX-80, which implies a certain amount of hardware design, it was a lot more than a gleam in Clive's eye when he departed the doomed Radionics in August.

Demon seed

The ZX-80 wasn't much of a computer. Five years after its launch in February 1980, Sinclair cheerfully admits that the machine's specifications had more to do with marketing considerations than application.

At the end of the seventies, personal computers weighed in at around £300. Clive's aim with the ZX-80 was simply to bring out a machine for less than £100, whatever the effects of such a constraint on the ultimate usefulness of the product.

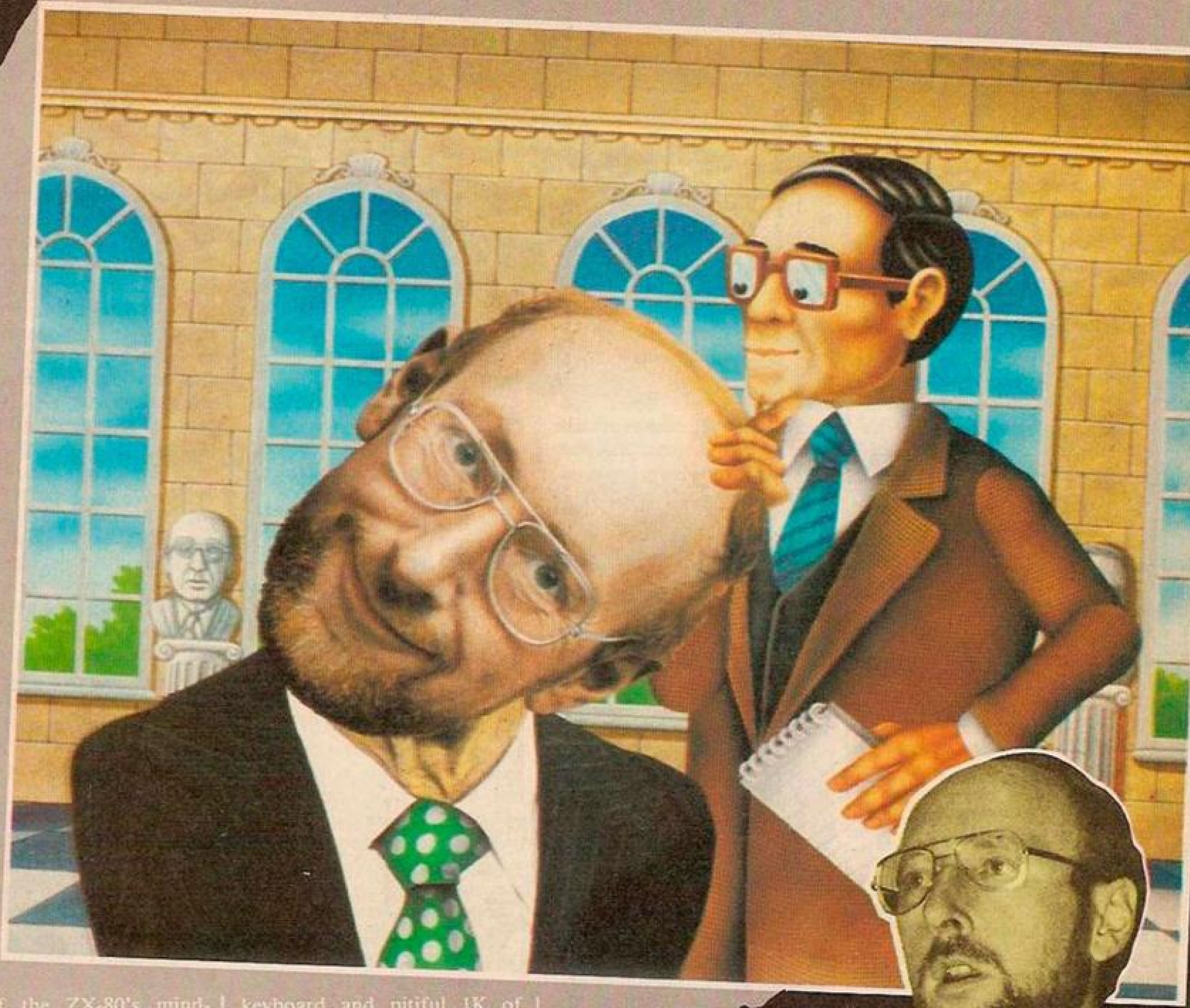
It's often argued that technical innovation (specifically Clive's) has always been at the heart of Sinclair's ability to successfully undercut the competition. Although this is certainly true of the ZX-81 with Ferranti's revolutionary ULA a determining factor in the machine's low price, there was nothing remotely innovative about the ZX-80.

For the purposes of this history, the machine is only important because it inadvertantly established the hard- and software foundations for the entire ZX range. The ZX-81 was a ZX-80 upgrade, the Spectrum was a ZX-81 with colour and the QL was . . . well, we'll worry about the QL later.

In short, everything you've learned to dread about a Sinclair computing product has its roots in the ZX-80's design. For example, keyboard layout.

On the face of it, single keystroke Basic is a great idea for beginners. However, as an entire generation of ZX programmers will testify, the advantages of the system are insufficient compensation for the horror of the keyboard.

Single keystroke Basic was the result of a marketing decision. Clive decided that few of his customers were likely to be typists, and that the ability to enter entire keywords with a single keystroke would be a valuable sales feature. The inspiration for such a system came from an old Wang machine at Radionics which used an obscure single-keystroke dialect.



As if the ZX-80's mind-numbing, multi-function keys weren't enough, the machine also boasted the first manifestation of the hideous membrane keyboard. Touch-insensitive and consistently fallible, the design is only remarkable in that it is entirely without supporters. Apart from Clive, of course.

In the final analysis, the ZX-80 was conceived, first and foremost, as an economy of components. As Clive has subsequently explained, his target audience was the old-style electronics hobbyist who on this occasion would hopefully be joined by a new breed of consumer electronics enthusiast.

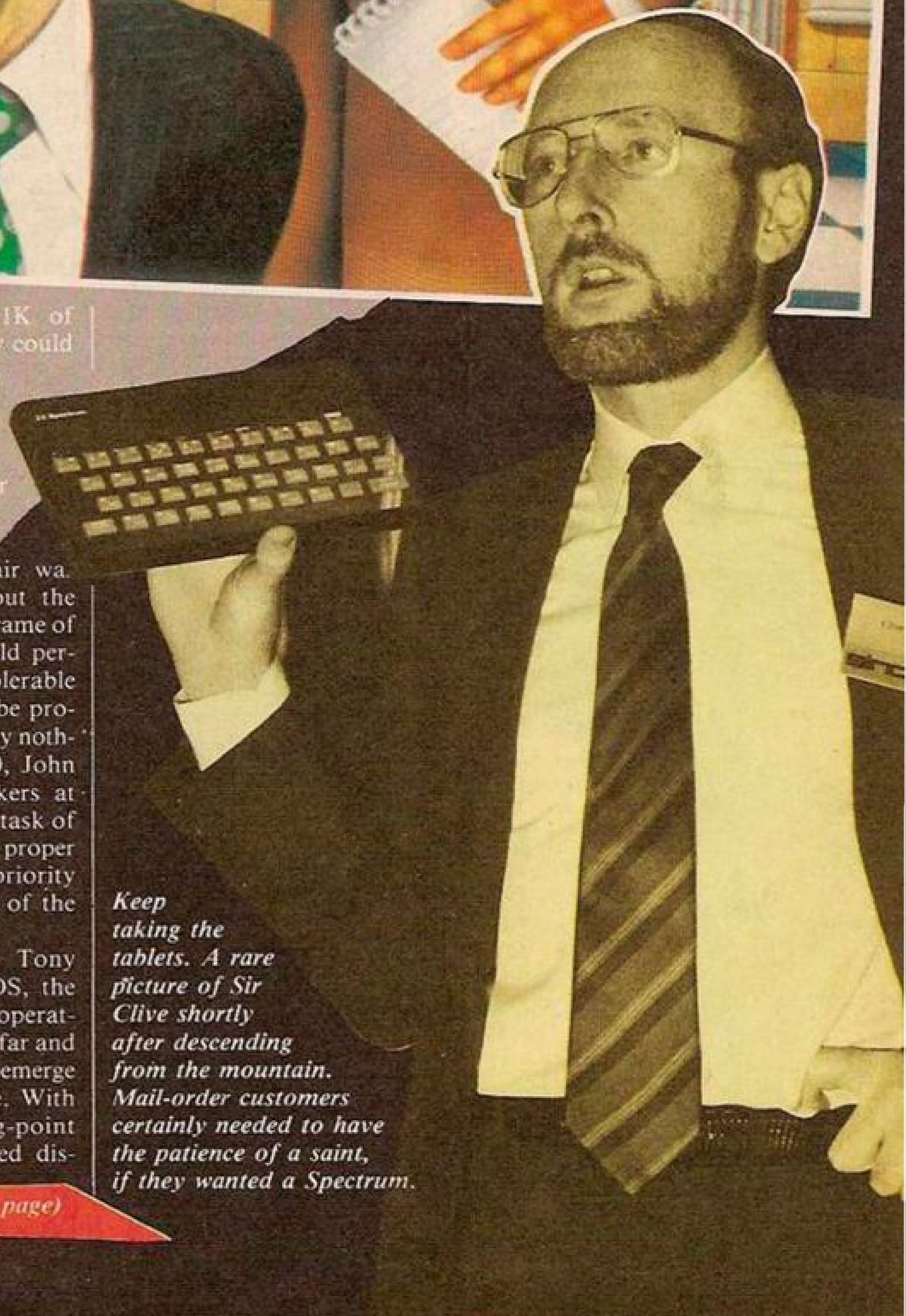
Sinclair was gambling on the support of the professional for whom a computer (however useless) would prove an irresistible image accessory. And the gamble paid off with a vengeance.

As far as the gritty world of "real" computing was concerned, the ZX-80 was little more than a portentous gizmo. With its integer only mathpack, the infamous screen flicker, joke keyboard and pitiful 1K of Ram, reviewers felt they could safely dismiss Sinclair's new product. In the year that followed, 25,000 unit sales revealed the error of their ways. Clive's time had come.

To his credit, Sinclair was under no illusions about the ZX-80. In a charitable frame of mind, the machine could perhaps be considered a tolerable learning aid for would-be programmers; it was certainly nothing more. In early 1980, John Grant and Steven Vickers at Nine Tiles set about the task of turning the ZX-80 into a proper computer, the first priority being the improvement of the mathpack.

In the opinion of Tony Tebby, author of QDOS, the QL's (almost) flawless operating system, the ZX-81 is far and away the best product to emerge from the Sinclair stable. With its expanded floating-point math package, improved dis-

(continued on next page)



Keep taking the tablets. A rare picture of Sir Clive shortly after descending from the mountain. Mail-order customers certainly needed to have the patience of a saint, if they wanted a Spectrum.

(continued from previous page)

play and partially improved storage capacity, the ZX-81 was in every way a "real" computer for less than the price of its predecessor.

A critical but hidden element in the rise and fall of Sinclair's ZX range is the software that Nine Tiles created for the ZX-80. Whatever the shortcomings of the machine, it is generally recognised that John Grant's software for the ZX-80 is a masterpiece of efficient and economic coding. Since this early work would become the foundation for the entire ZX range, its quality and objectives were crucial to future developments.

Although obvious given a moment's thought, most people are unaware of the literaly linear evolution of the software for the ZX range.

According to his technical staff, Clive seems to have very little interest or expertise in any aspect of software development. This goes some way towards explaining why he failed to realise that, although inspired, the ZX-80 software was simply an elegant solution to a very specific problem.

Like the NewBrain, the ZX-80's Basic was loosely based on the ANSI Minimal dialect. Grant saw his brief to be the creation of as full an implementation as possible given the constraints of the hardware.

In short, the design and structure of the ZX-80's software were specifically tailored to a machine with very little memory. It was never considered that the resultant code would serve as the software foundations for an entire range of machines with wildly different memory capacities.

Sinclair graft

Despite opposition from the programmers, when commissioning software for the ZX-81 and Spectrum, Clive insisted that existing code remain untouched, and any expansions effectively grafted on to the old software. This decision had little effect on the efficiency of the ZX-81, but would have serious consequences for the poor old Spectrum.

While investigating ways of refining the ZX-80's hardware for the new machine, Clive hit upon an innovation in chip design that was to make him a fortune. Ferranti had announced a new kind of chip known as an Uncommitted Logic Array or ULA.

The wonder of ULAs is that they enable limited customisation of an "off-the-peg" chip to suit a specific application, while avoiding the expense or delays of commissioning a full-blown custom chip. One of the problems with the ZX-80's hardware was its relatively high component count.

After speaking with Ferranti, Clive knew he could slam the contents of 17 ZX-80 chips onto a single ULA, thus reducing the new machine's chip count from 21 to four. The manufacturing economies were astounding. Ferranti's innovation enabled Sinclair to market an improved machine at a lower price, and in the process establish a market lead to intimidate the most determined competition.

The phenomenal success of the ZX-81 has been extensively chronicled over the years and hardly merits yet another re-run. Suffice to say that by the end of 1982 more than 500,000 units had been consumed by the technology-hungry masses of the world. The ZX-81 whisked Clive out of the world of the mail-order merchant and into the relative respectability of mainstream retailing.

By January 1981, Sinclair had signed an exclusive retail agreement with WH Smith. Both parties made significant fortunes out of the arrangement, which continued to flourish until a disagreement following the lukewarm response to the Spectrum.

The Spectrum earned its place in history as the world's first low-cost colour micro. More than any other product it is responsible for Sinclair's international reputation, but in the cold light of 1986 the old warhorse looks less than impressive.

The membrane keyboard is still there, it's raised rubber keypads — "like the touch of a deadman's hand" — only an inspiration to ZX-81 owners with limited ambition. These days the most impressive effect of the machine's additional features is that they make the keyboard even more awkward.

Code overload

Bestowed upon an expectant world in April 1982, the Spectrum's launch marked the end of an era for the ZX range. It was the last machine that used Nine Tiles for its software development. According to John Grant, coding structures originally designed for the ZX-80 finally collapsed beneath the demands of the Spectrum's massively expanded memory.

Code which had been clever and efficient handling data for a 1K system proved totally inadequate when applied to the processing requirements of a 16K or 48K Spectrum. In particular the neat but quirky system for storing variables, which used the 80's limited memory to its own advantage, was proving a liability on the Spectrum.

Nine Tiles recommended that the existing code be radically restructured for the Spectrum and Clive declined the suggestion. Grant insists that a £15,000 rewrite would have massively improved the Spectrum's capabilities and in the process extended its market life.

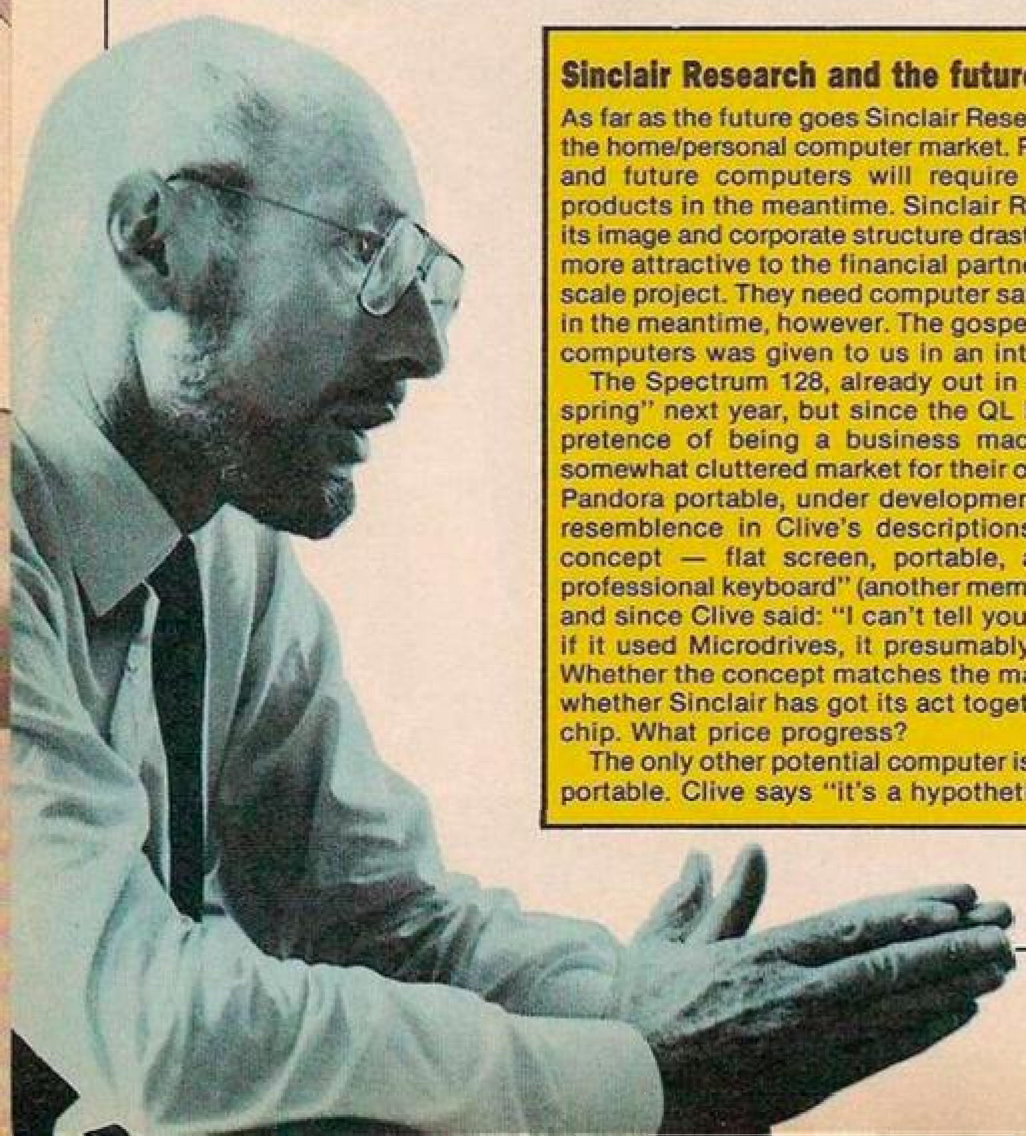
But it was not to be, and the result was an erratic, sluggish performance from the last of the ZX range. Ironically, the R&D of the most successful ZX product was plagued by technical disputes and financial disagreements.

Sinclair Research and the future

As far as the future goes Sinclair Research is still dependent upon the home/personal computer market. Plans for a Cellnet telephone and future computers will require income from the current products in the meantime. Sinclair Research has just revamped its image and corporate structure drastically, to make the company more attractive to the financial partners they need for the wafer-scale project. They need computer sales to keep the action going in the meantime, however. The gospel according to Clive on new computers was given to us in an interview.

The Spectrum 128, already out in Spain, will be released "in spring" next year, but since the QL has virtually abandoned all pretence of being a business machine, Sinclair will have a somewhat cluttered market for their own products, sub-£200. The Pandora portable, under development now, bears a remarkable resemblence in Clive's descriptions to the original ZX-83/QL concept — flat screen, portable, add-on modem, a "totally professional keyboard" (another membrane design, we presume), and since Clive said: "I can't tell you that", when we asked him if it used Microdrives, it presumably may well have 3in. discs. Whether the concept matches the machine will be a measure of whether Sinclair has got its act together. Oh, it will use the Z-80 chip. What price progress?

The only other potential computer is the Proteus, a 68000-based portable. Clive says "it's a hypothetical machine".



Most of the graft on the Spectrum's software was performed by Steven Vickers at Nine Tiles, while Richard Altwasser at Research handled the hardware and acted as a buffer between the two companies. When Altwasser and Vickers left their respective employers to design and market the Jupiter Ace, an already fraught development fell into disarray.

Although, on the face of it, only the I/O software remained to be completed, a difficult task was made impossible by an absence of working peripheral prototypes coupled with daily changes of brief.

In the end, the pressure of the launch deadline prompted Sinclair's decision to send out the first wave of Spectrums with unfinished Roms. The original QL or ZX-83 spec called for a Z-80 based portable machine, with the flat screen, Microdrives, built-in modem and bundled software. From this initial vision, progress was mainly downhill.

Chip changes

While problems with earlier machines can be laid at the door of Clive, those of the QL end up being assigned to Nigel Searle and his team, since Clive had little to do with it.

Having got his funding for the C5 electric bidet project when 10 per cent of Sinclair was sold — remember when the company was worth £130 million temporarily — Clive promptly moved out of Willis Road and Searle took over his office. However the initial vision was Clive's, and certain other decisions, like the chip.

The chip was changed to the 68008 in late '82, more for reasons of marketing than any benefits it offered. Apart from its capability to perform 32-bit arithmetic directly, and a larger memory addressing capability, this poor relation of the 68000 family has little going for it in computing terms. The restriction of the eight-bit address bus slows the whole thing down, and a Z-80 could run faster.

The cost differential now between the 16-bit 68000 and the 68008 is down to a few dollars. When Sinclair chose a



new hip chip, more to create the capacity to claim innovation and a "32-bit chip" in the ads than to improve their machine, the price differential was a lot more, 68000s being five times the price of 68008s.

Never one to spend a penny more on components than he has to (the QL hasn't got an On/Off switch either), Clive took the 68008, despite being told by Motorola at the time that they could now plastic package the 68000 — it was originally ceramic-packaged and hence pricey — and the price would drop.

Effectively, this decision has lumbered the QL with an illusorily advanced chip which renders it uncompetitive with Macintosh's 520STs and the like. Even if Digital Research can port the GEM system across to the QL, who's going to want it if it runs at half its original, itself boringly sedate, speed?

Monitor dropped

With the flat screen aborted, they went the monitor route. The idea of having a Sinclair monitor to go with the machine was dropped because they thought you couldn't sell a machine complete with a monitor — a fact Amstrad haven't noticed yet? Hedging their bets for the home market, a bodged TV outlet was added.

Portability also vanished, since the Dram chips would eat up too much power, even if the Microdrives would work quite happily on fairly small power requirements. With a flat screen they might have still tried it, but certainly not with a conventional TV tube.

Loss of portability also meant there were no good arguments for using the slow Microdrives, since they are not significantly cheaper to produce than 3.5in. disc systems are to buy. However the mindset at Sinclair says they have to be used, since they

Above: inside the Spectrum. Below: Clive and the QL.



are part of the "innovation".

It's the same thinking that gave us the QL keyboard, inappropriate for a "business" machine, despite the fact that a proper keyboard would cost less than a pound or more. Indeed, Sinclair had samples of such keyboards produced, but chose to do it his way.

The modem chip never got designed past the notional stage, let alone offered for BT approval, because of the other hardware problems in what was described to us as the "disorganised shambles" of QL design.

Meanwhile another machine, the SuperSpectrum, was started. With similar hardware to that of the QL, it was to be a 128K, 60008-based machine with Interface I and II built in — when they got them working — and aimed at the Spectrum market.

It was also to have a new Basic, which Jan Jones was recruited to write. When the QL development program went wrong, and the QL spec came resemble the SuperSpectrum as features were cut out, they dropped it.

The other machine that came along in '83 was the "low-cost colour computer" or LC-3, developed in response to the threat of a product from the East that would undermine the Spectrum's market. Produced in a very short time, it existed as a TTL prototype, complete with an OS and demo software.

It used a Z-80 and memory management, and was designed for Rom software, with data on battery-backed Cmos Ram packs. Apart from the initial cost advantages — it was to cost less than £50 — it had two advantages over the QL in the autumn of '83.

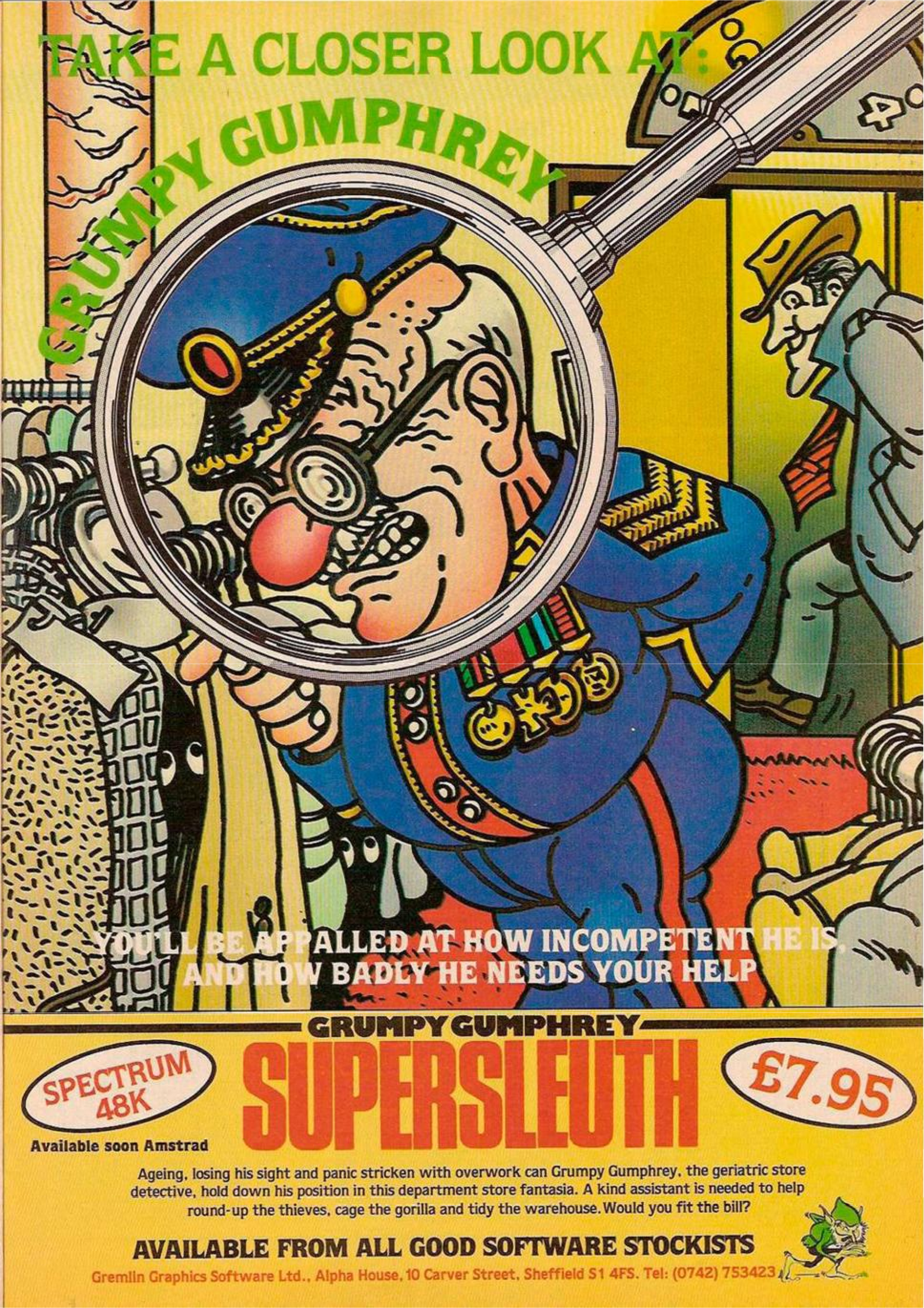
First, it could run full overlapping windows, and secondly, there was a full prototype. It was never developed further, presumably because profit margins didn't look as good as those of the QL. So much for cheap computing power!

Although QLs now work, it took up to D12 (the twelfth revision of the board) and a year to do so. There are still hangovers from a flawed design process, however.

Sinclair launched the QL without a working prototype. Despite a note of realism struck in the first draft of the press release, promising machines by "end-April", it went out as "end-February" because the ads said 28 days delivery, so the press release couldn't say any different". Decent, legal and honest?

The bugs in SuperBasic and the kludge deserve a mention. Up to a month before the launch, the QL was to have no Basic — it was supposed to be a business machine, remember — but then it was decided to use SuperBasic. Trouble was, SB was 22K in unfinished form, and another 4K of code was added to SuperBasic a month after the launch.

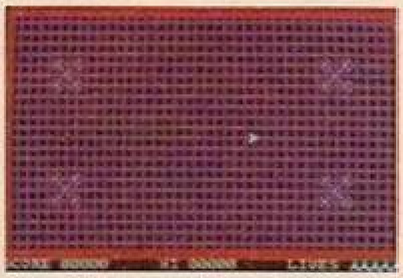
The OS, originally contracted to GST, had been produced for 2*16K Rom sockets. Tony Tebby's QDOS had been produced as a back-up, and would fit along with SuperBasic into a total of 48K. Hence the infamous kludge, pending 32K Roms.



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End Zone

S. Cartwright with a fast-moving arcade-type game for the Amstrad



End Zone is a machine code arcade-type game for Amstrad computers. At the start of each round your arrow head craft appears in the middle of the grid. Pressing one of the direction keys starts the craft moving in the chosen direction until you hit the perimeter of the grid, you change direction or get zapped!

Steer craft over spores.

Points are scored for steering your craft over the pattern of UDG's. Oops! Sorry; dormant nasty space spores! While avoiding the deadly plasma bolts of the patrolling guardians. When all the spores are collected you will enter a new grid with a different pattern. There are 10 different grids to attempt. Playing keys are shown at the beginning of each game.

To enter the program type in the Basic loader. Then save it in case of mistakes. Run the program and if the Ready appears type New. Don't worry, the code is still in memory. Enter as line 1:

1 MEMORY 34999:LOAD "EZcode": CALL 35000

Then as a direct command:

SAVE "ENDZONE": SAVE "EZCODE",B,35000,4875.

Program with auto run

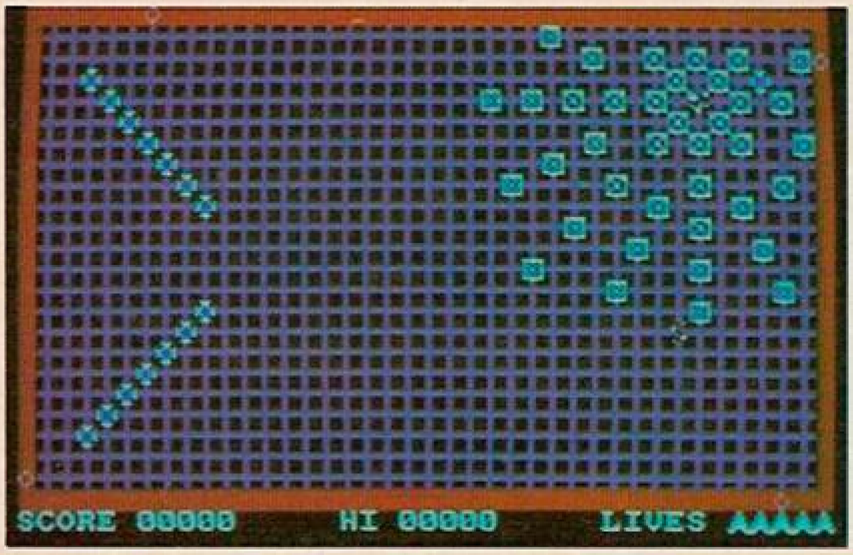
This will save the program to auto run. To load the game type RUN "ENDZONE" or RUN"" (CTRL and small Enter keys).

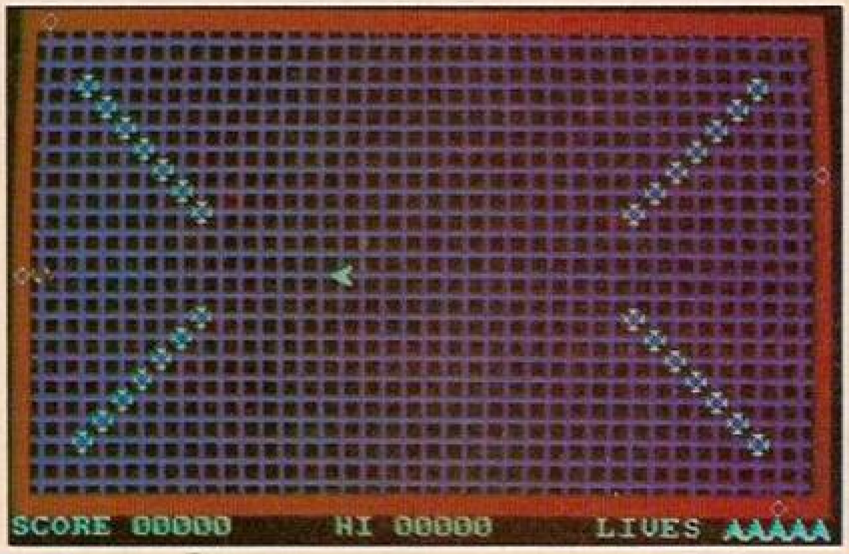
If you cannot be bothered to type in the program I will supply the game on cassette for £2.00. Send to S. Cartwright, 21 Maelog Place, Gabalfa, Cardiff.

Listing 1.

```
1 REM ********** AMSTRAD END ZONE COPY
  RIGHT 1985 S.CARTWRIGHT ********** 2
10 MEMORY 34999:FOR N=35000 TO 39875:
   READ D$:POKE N,VAL("&"+D$):NEXT N
20 REM  TO SAVE THE PROGRAM ONCE THE
21 '    DATA HAS BEEN POKED TYPE NEW
22 '    THEN ENTER THEN TYPE:-
23 '    1MEMORY 34999:LOAD"!EZCODE":
   CALL 35000
24 '    THEN ENTER THEN TYPE
25 '    SAVE"ENDZONE":SAVE "EZCODE",
   B,35000,4875
100 DATA 11,20,0,21,10,A4,CD,AB,BB
110 DATA 6,16,3E,A5,21,DB,88,C5,E5,F5
120 DATA CD,A8,BB,F1,3C,E1,11,8,0,19
130 DATA C1,10,F0,C3,88,89,18,18,3C,3C
140 DATA 7E,7E,E7,C3,C3,E7,7E,7E,3C,3C
150 DATA 18,18,3,F,3E,FC,FC,3E,F,3
160 DATA C0,F0,7C,3F,3F,7C,F0,C0,C3,81
170 DATA 24,18,18,24,81,C3,0,0,0,18
180 DATA 18,0,0,0,0,18,24,42,42,24
190 DATA 18,0,3C,42,81,81,81,81,42,3C
200 DATA 3C,18,A5,C3,C3,A5,18,3C,FF,C3
210 DATA A5,99,99,A5,C3,FF,18,66,42,99
220 DATA 99,42,66,18,E3,A1,27,18,18,E4
230 DATA 85,C7,7E,BD,DB,FF,FF,DB,BD,7E
240 DATA 18,3C,66,C3,C3,66,3C,18,5A,99
250 DATA 24,C3,C3,24,99,5A,83,CE,58,64
260 DATA 26,1A,E3,C1,24,5A,81,42,42,81
270 DATA 5A,24,0,0,0,0,1,3,6,C
280 DATA C,6,3,1,0,0,0,0,30,60
290 DATA C0,80,0,0,0,0,0,0,0,0
300 DATA 80,C0,60,30,24,5A,89,46,62,91
310 DATA 5A,24,21,0,0,22,65,95,21,0
320 DATA 0,22,5D,95,3E,5,32,67,95,3E
330 DATA 1,32,96,95,3E,1,21,7A,94,CD
340 DATA BC,BC,3E,2,21,87,94,CD,BC,BC
350 DATA 3E,3,21,94,94,CD,BC,BC,3E,4
360 DATA 21,A1,94,CD,BC,BC,3E,3,21,A5
370 DATA 94,CD,BF,BC,CD,DF,89,CD,37,92
380 DATA CD,DF,89,3A,67,95,FE,0,28,B8
390 DATA CD,DF,89,C3,E,8A,3E,1,CD,E
400 DATA BC,3E,0,1,0,0,CD,32,BC,3E
410 DATA 1,6,6,E,6,CD,32,BC,3E,2
420 DATA 6,0,E,0,CD,32,BC,1,0,0
430 DATA CD,38,BC,3E,3,6,1A,E,1A,CD
440 DATA 32,BC,C9,3E,1,32,6F,95,32,77
450 DATA 95,32,4C,99,3E,12,32,6E,95,32
460 DATA 76,95,3E,5,32,71,95,32,79,95
470 DATA 3E,1,32,70,95,32,78,95,3E,28
480 DATA 32,73,95,32,7B,95,3E,5,32,72
490 DATA 95,32,7A,95,3E,22,32,75,95,32
500 DATA 7D,95,3E,18,32,74,95,32,7C,95
510 DATA 3E,AA,32,7E,95,3E,A8,32,83,95
520 DATA AF,32,84,95,32,85,95,32,92,95
530 DATA 32,93,95,32,94,95,32,95,95,3E
540 DATA D,32,86,95,32,88,95,3E,15,32
550 DATA 87,95,32,89,95,3E,2,CD,90,BB
560 DATA 26,2,2E,2,E5,CD,75,BB,3E,9F
570 DATA CD,5D,BB,E1,24,3E,28,BC,20,F0
580 DATA 26,2,2C,3E,18,BD,20,E8,3E,1
590 DATA CD,90,BB,6,14,C5,2E,1,60,CD
600 DATA 75,BB,3E,8F,CD,5D,BB,C1,C5,2E
610 DATA 18,60,CD,75,BB,3E,8F,CD,5D,BB
620 DATA C1,C5,2E,18,3E,29,90,67,CD,75
630 DATA BB,3E,8F,CD,5D,BB,C1,C5,2E,1
640 DATA 3E,29,90,67,CD,75,BB,3E,8F,CD
650 DATA 5D,BB,C1,10,C4,6,C,C5,26,1
660 DATA 3E,D,90,6F,CD,75,BB,3E,8F,CD
670 DATA 5D,BB,C1,C5,26,28,3E,D,90,6F
680 DATA CD,75,BB,3E,8F,CD,5D,BB,C1,C5
690 DATA 26,1,3E,C,80,6F,CD,75,BB,3E
700 DATA 8F,CD,5D,BB,C1,C5,26,28,3E,C
710 DATA 80,6F,CD,75,BB,3E,8F,CD,5D,BB
720 DATA C1,10,BE,16,1A,D5,3E,2,42,4A
730 DATA CD,32,BC,6,A,CD,F,92,D1,15
740 DATA 3E,1,BA,20,EC,3E,3,CD,90,BB
750 DATA 26,1,2E,19,CD,75,BB,21,B2,94
760 DATA 6,6,CD,3C,9B,2A,5D,95,CD,59
770 DATA 9B,26,11,2E,19,CD,75,BB,21,B8
780 DATA 94,6,3,CD,3C,9B,2A,65,95,CD
790 DATA 59,9B,26,1E,2E,19,CD,75,BB,6
800 DATA 6,21,68,95,CD,3C,9B,3A,67,95
810 DATA 47,C5,3E,A5,CD,5D,BB,C1,10,F7
820 DATA 3E,1,CD,9F,BB,CD,F7,92,CD,6C
830 DATA 94,3E,1,CD,90,BB,2A,76,95,CD
840 DATA 75,BB,3E,8F,CD,5D,BB,3E,3,CD
850 DATA 90,BB,2A,6E,95,22,76,95,CD,75
860 DATA BB,3A,7E,95,CD,5D,BB,3E,1,CD
870 DATA 90,BB,2A,78,95,CD,75,BB,3E,8F
880 DATA CD,5D,BB,3E,3,CD,90,BB,2A,70
890 DATA 95,22,78,95,CD,75,BB,3A,7E,95
900 DATA CD,5D,BB,3E,1,CD,90,BB,2A,7A
910 DATA 95,CD,75,BB,3E,8F,CD,5D,BB,3E
920 DATA 3,CD,90,BB,2A,72,95,22,7A,95
930 DATA CD,75,BB,3A,7E,95,CD,5D,BB,3E
940 DATA 1,CD,90,BB,2A,7C,95,CD,75,BB
950 DATA 3E,8F,CD,5D,BB,3E,3,CD,90,BB
960 DATA 2A,74,95,22,7C,95,CD,75,BB,3A
970 DATA 7E,95,CD,5D,BB,3A,7E,95,3C,FE
980 DATA AD,20,2,3E,AA,32,7E,95,3E,2C
990 DATA CD,1E,BB,28,13,CD,B6,BC,2E,1
1000 DATA CD,48,9B,CD,18,BB,38,FB,CD,18
1010 DATA BB,CD,B9,BC,CD,1F,9B,11,77,EC
1020 DATA A7,ED,52,38,7,3E,1,32,7F,95
1030 DATA 18,10,CD,1F,9B,11,88,13,A7,ED
1040 DATA 52,30,5,3E,FF,32,7F,95,3A,7F
1050 DATA 95,2A,6E,95,85,FE,1,28,7,FE
1060 DATA 18,28,3,32,6E,95,CD,1F,9B,11
1070 DATA 77,EC,A7,ED,52,38,7,3E,1,32
1080 DATA 80,95,18,10,CD,1F,9B,11,88,13
1090 DATA A7,ED,52,30,5,3E,FF,32,80,95
1100 DATA 3A,80,95,2A,70,95,84,FE,1,28
1110 DATA 7,FE,28,28,3,32,71,95,CD,1F
1120 DATA 9B,11,77,EC,A7,ED,52,38,7,3E
1130 DATA 1,32,81,95,18,10,CD,1F,9B,11
1140 DATA 88,13,A7,ED,52,30,5,3E,FF,32
1150 DATA 81,95,3A,81,95,2A,72,95,85,FE
1160 DATA 1,28,7,FE,18,28,3,32,72,95
1170 DATA CD,1F,9B,11,77,EC,A7,ED,52,38
1180 DATA 7,3E,1,32,82,95,18,10,CD,1F
1190 DATA 9B,11,88,13,A7,ED,52,30,5,3E
1200 DATA FF,32,82,95,3A,82,95,2A,74,95
1210 DATA 84,FE,1,28,7,FE,28,28,3,32
1220 DATA 75,95,2A,88,95,CD,75,BB,3E,2
1230 DATA CD,90,BB,AF,CD,9F,BB,3E,9F,CD
1240 DATA 5D,BB,3E,1,CD,9F,BB,2A,86,95
1250 DATA 22,88,95,CD,75,BB,3E,3,CD,90
1260 DATA BB,3A,83,95,CD,5D,BB,3A,92,95
1270 DATA FE,1,20,3D,2A,8A,95,E5,11,CB
1280 DATA 94,ED,53,5B,95,CD,18,92,E1,44
1290 DATA 4D,CD,8A,90,3A,4C,99,FE,0,CA
1300 DATA D2,89,24,22,8A,95,3E,28,BC,28
1310 DATA 14,CD,18,92,ED,4B,8A,95,CD,8A
1320 DATA 90,3A,4C,99,FE,0,CA,D2,89,18
1330 DATA 4,AF,32,92,95,3A,93,95,FE,1
1340 DATA 20,3D,2A,8C,95,E5,11,BB,94,ED
1350 DATA 53,5B,95,CD,18,92,E1,44,4D,CD
1360 DATA 8A,90,3A,4C,99,FE,0,CA,D2,89
1370 DATA 2C,22,8C,95,3E,18,BD,28,14,CD
1380 DATA 18,92,ED,4B,8C,95,CD,8A,90,3A
1390 DATA 4C,99,FE,0,CA,D2,89,18,4,AF
1400 DATA 32,93,95,3A,94,95,FE,1,20,3D
1410 DATA 2A,8E,95,E5,11,CB,94,ED,53,5B
1420 DATA 95,CD,18,92,E1,44,4D,CD,8A,90
1430 DATA 3A,4C,99,FE,0,CA,D2,89,25,22
1440 DATA 8E,95,3E,1,BC,28,14,CD,18,92
1450 DATA ED,4B,8E,95,CD,8A,90,3A,4C,99
1460 DATA FE,0,CA,D2,89,18,4,AF,32,94
1470 DATA 95,3A,95,95,FE,1,20,3D,2A,90
1480 DATA 95,E5,11,BB,94,ED,53,5B,95,CD
1490 DATA 18,92,E1,44,4D,CD,8A,90,3A,4C
1500 DATA 99,FE,0,CA,D2,89,2D,22,90,95
1510 DATA 3E,1,BD,28,14,CD,18,92,ED,4B
1520 DATA 90,95,CD,8A,90,3A,4C,99,FE,0
1530 DATA CA,D2,89,18,4,AF,32,95,95,3A
1540 DATA 92,95,FE,1,28,3E,3A,6E,95,47
1550 DATA 3A,86,95,B8,20,34,3E,4,CD,AD
1560 DATA BC,E6,80,20,6,21,A9,94,CD,AA
1570 DATA BC,3E,1,32,92,95,2A,6E,95,24
1580 DATA 22,8A,95,11,CB,94,ED,53,5B,95
1590 DATA CD,18,92,ED,4B,8A,95,CD,8A,90
1600 DATA 3A,4C,99,FE,0,CA,D2,89,3A,93
1610 DATA 95,FE,1,28,3E,3A,71,95,47,3A
1620 DATA 87,95,B8,20,34,3E,4,CD,AD,BC
1630 DATA E6,80,20,6,21,A9,94,CD,AA,BC
1640 DATA 3E,1,32,93,95,2A,70,95,2C,22
1650 DATA 8C,95,11,BB,94,ED,53,5B,95,CD
1660 DATA 18,92,ED,4B,8C,95,CD,8A,90,3A
1670 DATA 4C,99,FE,0,CA,D2,89,3A,94,95
1680 DATA FE,1,28,3E,3A,72,95,47,3A,86
1690 DATA 95,B8,20,34,3E,4,CD,AD,BC,E6
1700 DATA 80,20,6,21,A9,94,CD,AA,BC,3E
1710 DATA 1,32,94,95,2A,72,95,25,22,8E
1720 DATA 95,11,CB,94,ED,53,5B,95,CD,18
1730 DATA 92,ED,4B,8E,95,CD,8A,90,3A,4C
1740 DATA 99,FE,0,CA,D2,89,3A,95,95,FE
1750 DATA 1,28,3E,3A,75,95,47,3A,87,95
1760 DATA B8,20,34,3E,4,CD,AD,BC,E6,80
1770 DATA 20,6,21,A9,94,CD,AA,BC,3E,1
1780 DATA 32,95,95,2A,74,95,2D,22,90,95
1790 DATA 11,BB,94,ED,53,5B,95,CD,18,92
1800 DATA ED,4B,90,95,CD,8A,90,3A,4C,99
1810 DATA FE,0,CA,D2,89,3E,43,CD,1E,BB
1820 DATA 20,7,CD,24,BB,E6,1,28,10,AF
1830 DATA 32,84,95,3E,1,32,85,95,3E,A5
1840 DATA 32,83,95,18,58,3E,45,CD,1E,BB
1850 DATA 20,7,CD,24,BB,E6,2,28,10,AF
1860 DATA 32,84,95,3E,FF,32,85,95,3E,A6
1870 DATA 32,83,95,18,3A,3E,27,CD,1E,BB
1880 DATA 20,7,CD,24,BB,E6,4,28,10,AF
1890 DATA 32,85,95,3E,FF,32,84,95,3E,A7
1900 DATA 32,83,95,18,1C,3E,1F,CD,1E,BB
1910 DATA 20,7,CD,24,BB,E6,8,28,E,AF
1920 DATA 32,85,95,3E,1,32,84,95,3E,A8
1930 DATA 32,83,95,3A,84,95,FE,FF,20,D
1940 DATA 3A,87,95,3D,FE,1,28,3C,32,87
1950 DATA 95,18,37,FE,1,20,D,3A,87,95
1960 DATA 3C,FE,28,28,2B,32,87,95,18,26
1970 DATA 3A,85,95,FE,1,20,D,3A,86,95
1980 DATA 3D,FE,1,28,17,32,86,95,18,12
1990 DATA 3A,85,95,FE,FF,20,B,3A,86,95
2000 DATA 3C,FE,18,28,3,32,86,95,2A,86
2010 DATA 95,CD,75,BB,3A,4D,99,47,CD,60
2020 DATA BB,B8,20,4B,3E,2,CD,AD,BC,E6
2030 DATA 80,20,6,21,98,94,CD,AA,BC,26
2040 DATA 7,2E,19,CD,75,BB,AF,CD,9F,BB
2050 DATA 2A,5D,95,11,5,0,19,22,5D,95
2060 DATA CD,59,9B,3E,1,CD,9F,BB,3A,4B
2070 DATA 99,3D,32,4B,99,20,16,3A,96,95
2080 DATA 3C,32,96,95,FE,B,20,5,3E,1
2090 DATA 32,96,95,CD,CD,91,C3,D2,89,C3
2100 DATA 8F,8B,C9,3A,86,95,B9,C0,3A,87
2110 DATA 95,B8,C0,AF,CD,9F,BB,CD,A7,BC
2120 DATA 21,8B,94,CD,AA,BC,3E,A9,32,50
2130 DATA 99,6,7,C5,6,40,11,DB,94,C5
2140 DATA 1A,47,3A,86,95,80,6F,13,1A,47
2150 DATA 3A,87,95,80,67,D5,7D,D6,2,FE
2160 DATA 16,30,10,7C,D6,2,FE,26,30,9
2170 DATA CD,75,BB,3A,50,99,CD,5D,BB,D1
2180 DATA 13,C1,10,D3,3A,50,99,3C,32,50
2190 DATA 99,C1,10,C3,AF,32,4C,99,3A,67
2200 DATA 95,3D,32,67,95,3E,1,CD,9F,BB
2210 DATA 3A,67,95,FE,0,C2,CD,91,2A,65
2220 DATA 95,ED,5B,5D,95,A7,ED,52,30,5
2230 DATA 62,6B,22,65,95,3E,25,32,63,95
2240 DATA 3E,15,32,64,95,3E,2,32,62,95
2250 DATA 32,61,95,CD,A7,BC,AF,CD,9F,BB
2260 DATA 3E,1,CD,90,BB,6,B,C5,3A,63
2270 DATA 95,47,C5,CD,3,92,3A,62,95,3C
2280 DATA 32,62,95,C1,10,F2,3A,64,95,47
2290 DATA C5,CD,3,92,3A,61,95,3C,32,61
2300 DATA 95,C1,10,F2,3A,63,95,47,C5,CD
2310 DATA 3,92,3A,62,95,3D,32,62,95,C1
2320 DATA 10,F2,3A,64,95,47,C5,CD,3,92
2330 DATA 3A,61,95,3D,32,61,95,C1,10,F2
2340 DATA 3A,64,95,D6,2,32,64,95,3A,63
2350 DATA 95,D6,2,32,63,95,3A,61,95,3C
2360 DATA 32,61,95,3A,62,95,3C,32,62,95
2370 DATA C1,10,96,3E,2,CD,90,BB,3E,A8
2380 DATA 32,4D,99,6,C,C5,78,C6,1,47
2390 DATA 4F,3E,2,CD,32,BC,3E,55,32,4B
2400 DATA 99,21,51,99,22,4E,99,CD,FE,93
2410 DATA 3A,4D,99,3C,32,4D,99,C1,10,DD
2420 DATA 2E,5,CD,48,9B,C9,CD,A7,BC,21
2430 DATA 0,C0,36,F0,11,1,C0,6,8,C5
2440 DATA 1,FF,7,CD,19,BB,ED,B0,6,3C
2450 DATA CD,F,92,C1,10,EF,1B,1B,36,0
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End Zone






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2460 DATA 6,8,C5,1,FF,7,CD,19,BD,ED
2470 DATA B8,6,3C,CD,F,92,C1,10,EF,C9
2480 DATA 2A,61,95,CD,75,BB,3E,E9,CD,5D
2490 DATA BB,C9,C5,6,FF,10,FE,C1,10,F8
2500 DATA C9,25,2D,CD,1A,BC,E5,ED,5B,5B
2510 DATA 95,E,8,6,2,1A,AE,77,13,23
2520 DATA 10,F9,E1,CD,26,BC,E5,D,20,EF
2530 DATA E1,C9,3E,1,6,2,E,7,CD,32
2540 DATA BC,26,1,2E,1,CD,3E,BC,3E,1
2550 DATA CD,90,BB,3E,1,CD,E,BC,26,D
2560 DATA 2E,6,CD,75,BB,21,FB,99,6,F
2570 DATA CD,EB,92,26,D,2E,7,CD,75,BB
2580 DATA 21,A,9A,6,10,CD,EB,92,26,D
2590 DATA 2E,8,CD,75,BB,21,1A,9A,6,10
2600 DATA CD,EB,92,26,D,2E,9,CD,75,BB
2610 DATA 21,2A,9A,6,10,CD,EB,92,26,D
2620 DATA 2E,A,CD,75,BB,21,3A,9A,6,F
2630 DATA CD,EB,92,26,B,2E,C,CD,75,BB
2640 DATA 21,49,9A,6,14,CD,EB,92,26,D
2650 DATA 2E,D,CD,75,BB,21,5D,9A,6,E
2660 DATA CD,EB,92,26,C,2E,E,CD,75,BB
2670 DATA 21,6B,9A,6,11,CD,EB,92,26,B
2680 DATA 2E,F,CD,75,BB,21,7C,9A,6,10
2690 DATA CD,EB,92,26,B,2E,10,CD,75,BB
2700 DATA 21,8C,9A,6,14,CD,EB,92,CD,1C
2710 DATA 94,C9,C5,7E,E5,CD,5D,BB,E1,23
2720 DATA C1,10,F5,C9,3A,96,95,FE,1,20
2730 DATA 14,3E,14,32,4B,99,3E,A9,32,4D
2740 DATA 99,21,97,95,22,4E,99,CD,FE,93
2750 DATA C9,3A,96,95,FE,2,20,14,3E,1C
2760 DATA 32,4B,99,3E,AD,32,4D,99,21,BF
2770 DATA 95,22,4E,99,CD,FE,93,C9,3A,96
2780 DATA 95,FE,3,20,14,3E,40,32,4B,99
2790 DATA 3E,AE,32,4D,99,21,F7,95,22,4E
2800 DATA 99,CD,FE,93,C9,3A,96,95,FE,4
2810 DATA 20,14,3E,24,32,4B,99,3E,AF,32
2820 DATA 4D,99,21,77,96,22,4E,99,CD,FE
2830 DATA 93,C9,3A,96,95,FE,5,20,14,3E
2840 DATA 2A,32,4B,99,3E,B0,32,4D,99,21
2850 DATA BF,96,22,4E,99,CD,FE,93,C9,3A
2860 DATA 96,95,FE,6,20,14,3E,3C,32,4B
2870 DATA 99,3E,B1,32,4D,99,21,13,97,22
2880 DATA 4E,99,CD,FE,93,C9,3A,96,95,FE
2890 DATA 7,20,14,3E,24,32,4B,99,3E,B2
2900 DATA 32,4D,99,21,8B,97,22,4E,99,CD
2910 DATA FE,93,C9,3A,96,95,FE,8,20,14
2920 DATA 3E,70,32,4B,99,3E,B3,32,4D,99
2930 DATA 21,D3,97,22,4E,99,CD,FE,93,C9
2940 DATA 3A,96,95,FE,9,20,14,3E,28,32
2950 DATA 4B,99,3E,B4,32,4D,99,21,B3,98
2960 DATA 22,4E,99,CD,FE,93,C9,3E,24,32
2970 DATA 4B,99,3E,B5,32,4D,99,21,3,99
2980 DATA 22,4E,99,CD,FE,93,C9,3A,4B,99
2990 DATA 47,ED,5B,4E,99,C5,1A,6F,13,1A
3000 DATA 67,D5,CD,75,BB,3A,4D,99,CD,5D
3010 DATA BB,D1,13,C1,10,EB,C9,CD,1B,BB
3020 DATA 38,FB,3E,3,CD,90,BB,11,A0,9A
3030 DATA 6,7F,C5,D5,26,28,2E,19,CD,75
3040 DATA BB,1A,CD,5D,BB,6,2,C5,11,80
3050 DATA C7,6,8,CD,19,BD,CD,19,BD,C5
3060 DATA D5,62,6B,23,1,4F,0,ED,B0,D1
3070 DATA EB,CD,26,BC,EB,C1,10,ED,C1,10
3080 DATA DE,A7,CD,1B,BB,38,7,D1,13,C1
3090 DATA 10,C4,18,BD,D1,C1,C9,AF,CD,AD
3100 DATA BC,E6,80,C0,21,7E,94,CD,AA,BC
3110 DATA C9,3,64,A,14,1,1,0,0,2
3120 DATA 0,2,80,0,3,64,3,1,1,2
3130 DATA 0,C8,0,5,1,0,64,3,F,1
3140 DATA 1,2,3,0,0,0,A,F,32,0
3150 DATA 3,3C,FF,A,3,1E,FF,A,4,4
3160 DATA 3,50,0,F,1,50,0,53,43,4F
3170 DATA 52,45,20,48,49,20,11,CC,33,88
3180 DATA 77,0,33,88,11,CC,0,EE,11,CC
3190 DATA 33,88,0,0,0,44,88,EE,DD,FF
3200 DATA FF,BB,77,11,22,0,0,0,FF,FF
3210 DATA 1,1,1,FF,FF,1,FE,0,2,FE
3220 DATA 0,2,FE,FE,FE,2,2,2,0,FE
3230 DATA 2,0,FC,0,0,FC,0,4,4,0
3240 DATA 4,FC,FC,4,FC,FC,4,4,6,0
3250 DATA 0,FA,0,6,FA,0,FE,FB,2,5
3260 DATA 2,FB,5,2,FB,FE,5,FE,FE,5
3270 DATA FB,2,3,F9,0,8,F9,FD,7,3
3280 DATA FA,6,0,F8,8,0,FA,FA,F9,3
3290 DATA 6,FA,3,7,F8,0,7,FD,FD,F9
3300 DATA 6,6,FD,7,9,FC,F8,8,F8,F8
3310 DATA 8,8,4,F7,0,A,F6,0,9,4
3320 DATA FC,F7,FC,9,8,F8,F7,FC,A,0
3330 DATA 0,F6,F7,4,4,9,0,0,0,0
3340 DATA 39,30,0,0,0,0,0,0,5,4C
3350 DATA 49,56,45,53,20,0,1,1,0,0
3360 DATA 28,19,0,0,1,1,0,0,28,19
3370 DATA 0,A9,0,0,0,0,A5,0,0,0
3380 DATA 0,0,0,0,0,0,0,0,0,0
3390 DATA 0,0,0,0,0,1,6,6,8,21
3400 DATA 12,7,11,23,8,8,13,6,13,21
3410 DATA 6,23,6,21,7,7,13,23,8,6
3420 DATA 13,8,11,6,8,23,12,22,6,8
3430 DATA 11,8,7,22,11,21,7,7,10,20
3440 DATA 5,24,15,4,4,4,8,21,13,23
3450 DATA F,A,9,9,A,1F,15,25,13,6
3460 DATA 5,5,4,25,11,8,12,22,14,5
3470 DATA 6,6,6,23,14,24,A,A,12,7
3480 DATA F,1F,7,22,10,9,9,20,8,8
3490 DATA 11,21,2,2,14,5,4,25,13,27
3500 DATA 2,6,16,2,12,2,17,23,2,22
3510 DATA 7,27,17,26,7,2,4,2,17,7
3520 DATA 14,24,5,27,5,5,17,4,15,27
3530 DATA 2,25,14,2,2,4,17,21,2,27
3540 DATA 17,24,4,4,6,2,17,5,15,25
3550 DATA 2,8,8,2,15,4,2,23,11,27
3560 DATA 17,8,17,2,3,27,3,3,11,2
3570 DATA 16,27,17,22,5,24,2,7,8,27
3580 DATA 2,21,17,27,3,2,13,2,17,6
3590 DATA 16,26,2,24,3,26,2,5,16,3
3600 DATA 12,27,6,27,5,2,15,2,14,27
3610 DATA 17,25,2,3,17,3,2,26,4,27
3620 DATA C,6,F,25,11,4,B,22,8,4
3630 DATA E,22,C,4,A,25,9,5,F,4
3640 DATA C,23,E,7,B,5,D,25,C,21
3650 DATA A,4,F,23,8,25,D,21,A,23
3660 DATA B,7,E,24,B,24,D,4,D,6
3670 DATA 11,25,C,8,C,25,F,6,9,24
3680 DATA E,5,A,6,10,24,D,8,D,23
3690 DATA 10,5,5,B,12,12,9,19,5,1A
3700 DATA 10,15,9,10,A,1B,5,E,6,10
3710 DATA 14,15,7,19,8,C,10,13,6,1E
3720 DATA 5,1C,7,B,12,17,13,13,A,E
3730 DATA 5,1B,9,1C,7,10,13,16,5,D
3740 DATA 9,D,8,1D,11,12,5,F,8,19
3750 DATA A,F,11,17,A,1A,6,B,5,1D
3760 DATA 10,16,5,C,6,19,14,14,5,1E
3770 DATA 8,10,7,1E,10,14,4,15,15,16
3780 DATA 5,14,14,17,6,13,13,18,7,12
3790 DATA 12,19,8,11,11,1A,9,10,10,1B
3800 DATA A,F,F,1C,B,E,E,1D,C,D
3810 DATA D,1E,D,D,C,1E,E,E,B,1D
3820 DATA F,F,A,1C,10,10,9,1B,11,11
3830 DATA 8,1A,12,12,7,19,13,13,6,18
3840 DATA 14,14,5,17,15,15,4,16,14,16
3850 DATA 5,15,13,17,6,14,12,18,7,13
3860 DATA 12,17,7,14,12,16,7,15,12,15
3870 DATA 7,16,12,14,7,17,12,13,7,18
3880 DATA 13,14,6,17,14,15,5,16,13,16
3890 DATA 6,15,13,15,6,16,3,4,3,3
3900 DATA 4,3,15,3,16,3,16,4,16,25
3910 DATA 16,26,15,26,4,26,3,26,3,25
3920 DATA 7,8,7,7,8,7,11,7,12,7
3930 DATA 12,8,12,21,12,22,11,22,8,22
3940 DATA 7,22,7,21,B,C,B,B,C,B
3950 DATA D,B,E,B,E,C,E,1D,E,1E
3960 DATA D,1E,C,1E,B,1E,B,1D,8,E
3970 DATA 11,E,11,1B,8,1B,4,E,15,E
3980 DATA 15,1B,4,1B,8,4,11,4,11,21
3990 DATA 4,21,6,6,13,6,13,23,6,23
4000 DATA 6,C,13,C,4,1F,11,1E,11,A
4010 DATA 8,7,8,21,15,A,4,A,15,25
4020 DATA 8,A,11,7,6,1D,8,25,11,25
4030 DATA 13,1D,15,8,4,8,8,1F,15,1F
4040 DATA 4,4,4,25,15,21,15,4,12,1B
4050 DATA 4,C,5,1B,8,1D,11,C,11,1C
4060 DATA 8,23,11,23,8,C,15,C,15,1D
4070 DATA 13,1B,4,6,15,6,13,4,6,4
4080 DATA 4,23,6,1B,11,5,8,5,4,1D
4090 DATA 15,23,14,B,8,8,7,B,7,22
4100 DATA 14,22,11,D,11,8,8,6,11,1F
4110 DATA 4,1E,8,22,11,22,11,B,7,4
4120 DATA 4,5,11,24,14,1B,8,1C,8,B
4130 DATA 15,5,4,24,4,1C,12,D,11,1D
4140 DATA 15,22,11,6,13,5,15,1C,12,24
4150 DATA 8,24,6,1C,4,D,15,B,13,1C
4160 DATA 15,1E,15,24,15,7,5,D,5,4
4170 DATA 7,1B,15,D,14,4,6,5,8,1E
4180 DATA 12,4,5,24,8,D,4,7,4,B
4190 DATA 4,22,2,12,D,A,8,20,15,14
4200 DATA 5,16,B,E,D,1C,17,19,2,19
4210 DATA B,B,17,12,F,1F,E,E,4,14
4220 DATA B,1D,15,17,E,B,D,21,14,15
4230 DATA C,F,4,17,E,1D,F,D,A,C
4240 DATA A,1F,5,15,F,1E,F,C,14,16
4250 DATA 3,18,D,F,C,1C,A,1E,16,13
4260 DATA C,21,A,D,3,13,16,18,E,20
4270 DATA C,A,4,E,16,1B,2,1C,16,D
4280 DATA 2,F,3,1A,17,F,17,19,2,C
4290 DATA 17,C,17,1C,2,19,17,1A,3,D
4300 DATA 16,F,3,1C,2,D,15,1B,3,F
4310 DATA 17,D,4,1B,3,E,16,1C,2,10
4320 DATA 15,E,17,1B,2,E,16,E,17,1D
4330 DATA 17,10,2,1A,3,1B,16,1A,2,1D
4340 DATA 17,E,2,1B,0,1,0,0,0,0
4350 DATA 11,11,9,1D,A,A,10,1D,8,13
4360 DATA B,16,10,A,E,17,12,18,8,19
4370 DATA 7,B,12,C,7,1E,8,10,F,14
4380 DATA B,C,12,1F,8,10,F,D,E,1E
4390 DATA B,1A,F,10,10,18,B,1E,A,13
4400 DATA 12,1C,9,16,E,B,E,19,F,1C
4410 DATA 11,D,7,D,11,17,9,1A,9,11
4420 DATA 10,13,7,1F,7,16,12,12,8,A
4430 DATA B,1D,7,11,11,A,8,1D,A,10
4440 DATA E,10,11,1C,10,D,7,1A,7,1D
4450 DATA B,B,F,17,F,1E,9,12,E,1C
4460 DATA 12,B,7,C,12,19,7,12,F,A
4470 DATA A,D,B,1F,8,17,8,13,11,13
4480 DATA 9,A,E,14,10,1C,9,13,E,C
4490 DATA 9,1E,8,1A,12,17,8,16,9,10
4500 DATA 10,11,11,1E,9,18,10,17,A,16
4510 DATA E,1D,A,1A,B,D,A,1D,E,18
4520 DATA 96,9A,9A,9A,9C,96,C3,20,20,20
4530 DATA 9E,96,9A,9A,C3,95,20,20,20,20
4540 DATA 95,B7,C3,20,20,95,95,20,20,B7
4550 DATA C3,97,9A,9D,20,20,95,20,B7,C3
4560 DATA 20,95,95,20,20,20,95,95,20,20
4570 DATA 20,20,95,20,20,B7,C3,95,95,20
4580 DATA 20,B6,C0,93,9A,9A,9A,99,9B,20
4590 DATA 20,20,B7,99,93,9A,9A,C0,96,9A
4600 DATA 9A,9C,20,C2,9A,C3,20,96,C3,20
4610 DATA 20,20,9E,96,9A,9A,9A,9C,B6,C0
4620 DATA C2,B8,20,B7,C3,95,B7,C3,20,20
4630 DATA 95,95,B6,C0,20,95,20,20,20,95
4640 DATA 95,20,B7,C3,20,95,97,9A,9D,B6
4650 DATA C0,20,20,C1,B9,20,B6,C0,95,20
4660 DATA 20,B7,C3,95,95,93,9A,9A,99,20
4670 DATA C1,9A,C0,20,9B,20,20,20,B7,99
4680 DATA 93,9A,9A,9A,99,A4,20,31,39,38
4690 DATA 35,20,57,49,4E,4B,59,57,41,4E
4700 DATA 4B,59,20,53,4F,46,54,57,41,52
4710 DATA 45,20,4C,74,64,2E,20,20,4B,45
4720 DATA 59,53,3A,2D,20,51,2D,55,50,20
4730 DATA 41,2D,44,4F,57,4E,20,3C,2D,4C
4740 DATA 45,46,54,20,3E,2D,52,49,47,48
4750 DATA 54,20,4F,52,20,4A,4F,59,53,54
4760 DATA 49,43,4B,20,20,20,20,20,48,20
4770 DATA 74,6F,20,48,4F,4C,44,20,20,20
4780 DATA 20,20,70,72,65,73,73,20,61,6E
4790 DATA 79,20,6B,65,79,20,74,6F,20,73
4800 DATA 74,61,72,74,20,20,20,20,20,20
4810 DATA 20,20,2A,5F,95,E5,29,29,29,29
4820 DATA 29,29,29,29,D1,19,11,29,0,19
4830 DATA 22,5F,95,C9,7D,C6,30,CD,5A,BB
4840 DATA C9,7E,E5,C5,CD,5D,BB,C1,E1,23
4850 DATA 10,F5,C9,6,0,C5,6,0,10,FE
4860 DATA C1,10,F8,2D,AF,BD,C2,48,9B,C9
4870 DATA 11,10,27,CD,8B,9B,CD,35,9B,EB
4880 DATA 11,E8,3,CD,8B,9B,CD,35,9B,EB
4890 DATA 11,64,0,CD,8B,9B,CD,35,9B,EB
4900 DATA 11,A,0,CD,8B,9B,CD,35,9B,EB
4910 DATA 11,1,0,CD,8B,9B,CD,35,9B,C9
4920 DATA 7A,2F,57,7B,2F,5F,13,E5,AF,67
4930 DATA 6F,E3,7A,B3,20,2,E1,C9,6,11
4940 DATA CB,15,CB,14,38,11,10,F8,18,15
4950 DATA E3,E5,19,D2,B0,9B,E3,E1,E3,CB
4960 DATA 15,CB,14,E3,CB,15,CB,14,E3,10
4970 DATA EB,D1,CB,2A,CB,1B,0,9999
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Colossus and White KNight author Martin Bryant rates the mates.



Psion Chess: best graphics, strongest game.

Video games may come and go, but chess programs just grow bigger and better every year! In this article I will take a look at the latest and best available on a variety of machines.

The programs chosen were Colossus Chess 4.0 (CBM-64), Cyrus II Chess (CPC-464), Psion Chess (QL), Superchess 3.5 (Spectrum) and White-Knight MK12 (BBC). All of these packages have existed for several years and have been written by enthusiastic computer-chess programmers. This is a very important guide to the programs' quality because today's chess programs, have reached such a level that no new program written by a casual programmer catch up on the years of development that have gone into the commercial offerings.

The programs' abilities are compared in table 1. Of course, an overall verdict of the "best" program is impossible, because people have different requirements from their programs. Also the hardware which the programs run on varies greatly so direct program comparison is impossible.

Where relative comparisons of features are possible, the best program has been given 10 out of 10 and the others a relative score. Other features are simple yes/no facts.

Gone are the days of chess programs which couldn't even beat a casual player on a bad day and programs took minutes to solve a simple mate-in-two.

Today's programs can give even the best club players a run for their money on tournament of blitz levels, and mates-in-two should now take at most a few seconds. Several programs are

White Knight MK12 finds Rf2-a2 in 29 seconds. See how long your own program takes...

Examples.

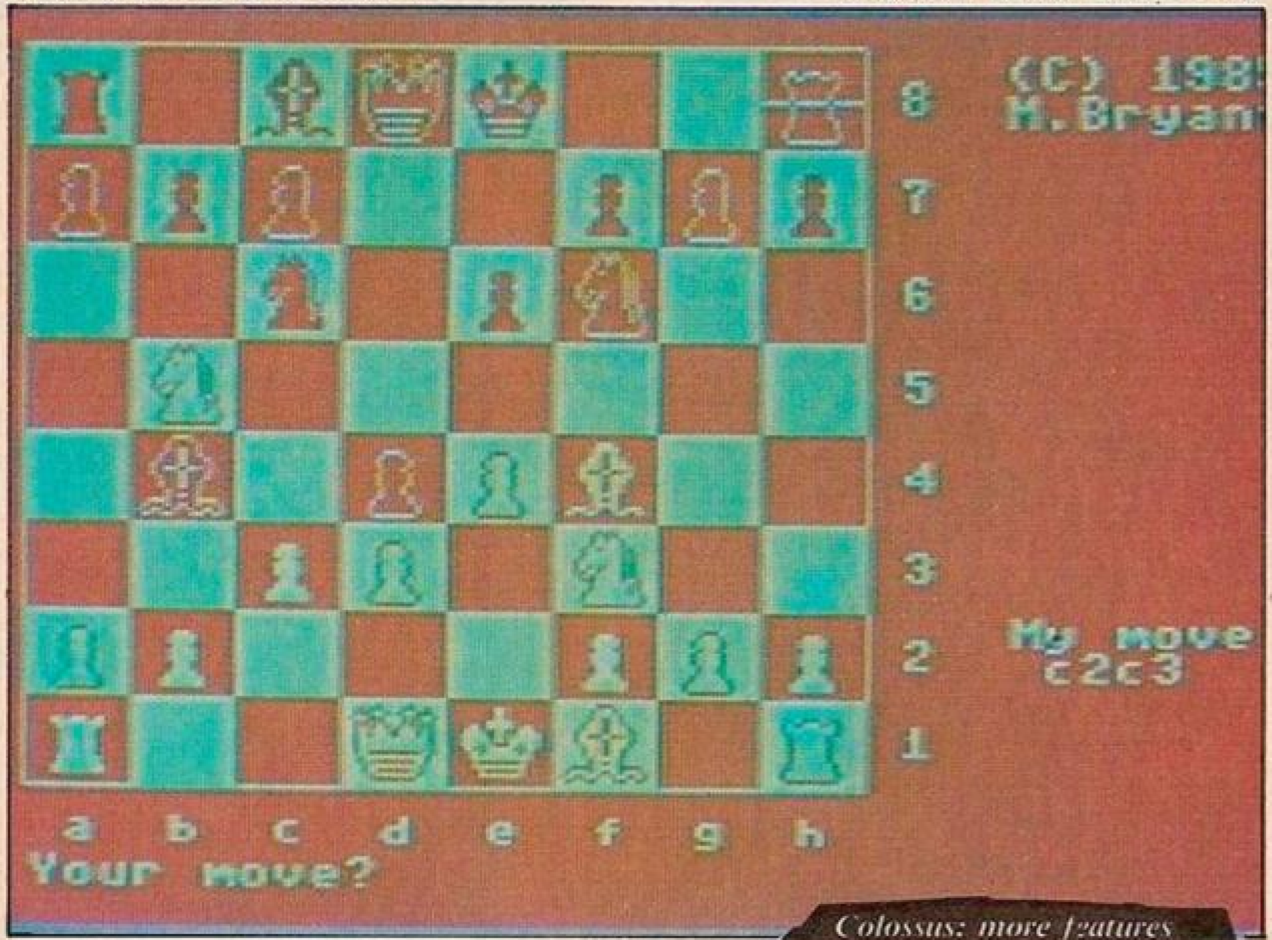
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.. ..    .. .. .. .. .. .. 6

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.. WB .. .. .. .. .. .. 2
.. WK .. .. .. .. .. .. 1
a  b    c  d  e  f  h  h
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(Forsyth notation: 1q5k/4R3/8/8/1p6/1B6/5R2/1K6)

Colossus Chess 4.0 versus Cyrus II Chess.

1.	e2-e4	e7-e5
2.	f1-c4	g8-f6
6.	d2-d3	b8-c6
4.	b1-c3	f8-c5
5.	g1-f3	d7-d6
6.	e1-g1	c8-g4
7.	c1-e3	c5×e3
8.	f2×e3	e8-g8
9.	a1-c1	d8-d7
10.	d1-d2	a7-a6
11.	c1-d1	b7-b5
12.	c4-b3	a8-b8
13.	c3-d5	f6×d5
14.	e4×d5	c8-e7
15.	e3-e4	b5-b4
16.	b3-c4	b8-b6
17.	f1-f2	f8-b8
18.	d1-f1	f7-f6
19.	h2-h3	g4×f3
20.	f2×f3	e7-g6
21.	d2-f2	g6-f4
22.	g1-h1	b8-b7
23.	f2-e1	d7-a4
24.	f1-f2	a4-e8
25.	b2-b3	e8-g6
26.	e1-f1	g6-h5
27.	a2-a4	a6-a5
28.	c4-b5	b7-a7
29.	h1-g1	h5-g6
30.	b5-c6	f6-f5
31.	g2-g3	f4-h5
32.	e4×f5	g6-h6
33.	f1-e1	h5-f6
34.	g3-g4	h6-g5
35.	e1-e2	g5-c1+
36.	f2-f1	c1-b2
37.	e2-f2	e5-e4
38.	d3×e4	f6×e4
39.	f2-e3	e4-f6
40.	g4-g5	b2×c2
41.	g5×f6	c2-c5
42.	e3×c5	d6×c5
43.	f3-g3	g7-g5
44.	g3×g5+	g8-f7



Colossus: more features than its rivals.

Chess Mates

45. g5-g7+	f7×f6
46. g7×h7	b6-a6
47. h7-h5	f6-e5
48. f5-f6+	e5-d6
49. f6-f7	a7-a8
50. c6-e8	c7-c6
51. f7-f8/9+	d6-c7
52. f1-f7+	c7-b6
53. d5×c6	a6-a7
54. f8×c5+	b6-a6
55. c5×a5+	checkmate

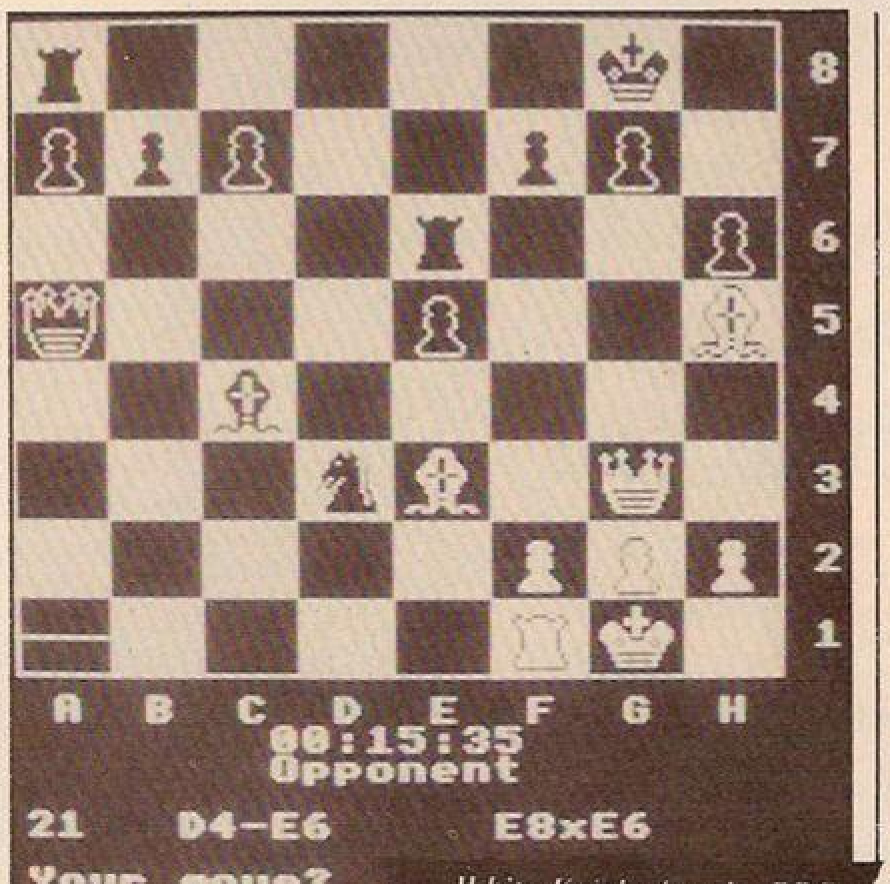
now able to spot some mates-in-five or even six on blitz levels in the middlegame. Psion Chess is the strongest home-computer chess program at the moment. It does run on much better hardware than the opposition — faster, better processor/more memory — of course than the opposition, but would still be a strong program with lesser hardware.

A version of Psion Chess, running on a Sage computer — about three times faster than a QL — came equal first with three other programs in the 1984 World Microcomputer Chess Championships. From the comparison table you'll also see that its rival are no pushovers!

Most modern programs will now think on the opponent'stime by anticipating your move and continuing its search. If you play the more it was expecting it can save itself a lot of time and thus search further ahead and play much better. Problem-solving has come a long way too. Colossus Chess now offers the ability to solve not only normalmates but self-mates and help-mates up to seven moves ahead. This is the only commercial program to offer these features.

White-Knight Mk12 is actually used by international chess grandmaster John Nunn to aid in problem solving and design. If a grandmaster finds it helpful, think how much it can help club players, or anybody interested in chess problem-solving. Also, the better programs offer the ability to check problems for "cooks", i.e. alternative solutions to the one the problem-author intended.

Nowadays, the programs usually offer more than the standard levels. The move is towards modes-of-play and levels being totally user-selectable by entering an average move time you wish to play at, thus providing thousands of levels. The new modes of play add to the normal averaged-move-time levels and they include easy-play where the program deliberately plays more weakly so that even useless players stand a chance; all-the-moves where — as in most casual games in chess clubs — the whole game must be completed within a certain pre-agreed time or the slowest player loses on time; equal-time where the program kindly monitors your rate of play and adjusts its own accordingly — if you play fast, it plays fast, if you slow down, so does it; infinite-search where the programs just looks further and further ahead until told to stop — useful for postal games where you can just leave the program to ponder a position overnight or even all week. Colossus provides six modes-of-play, more than any of the other programs.



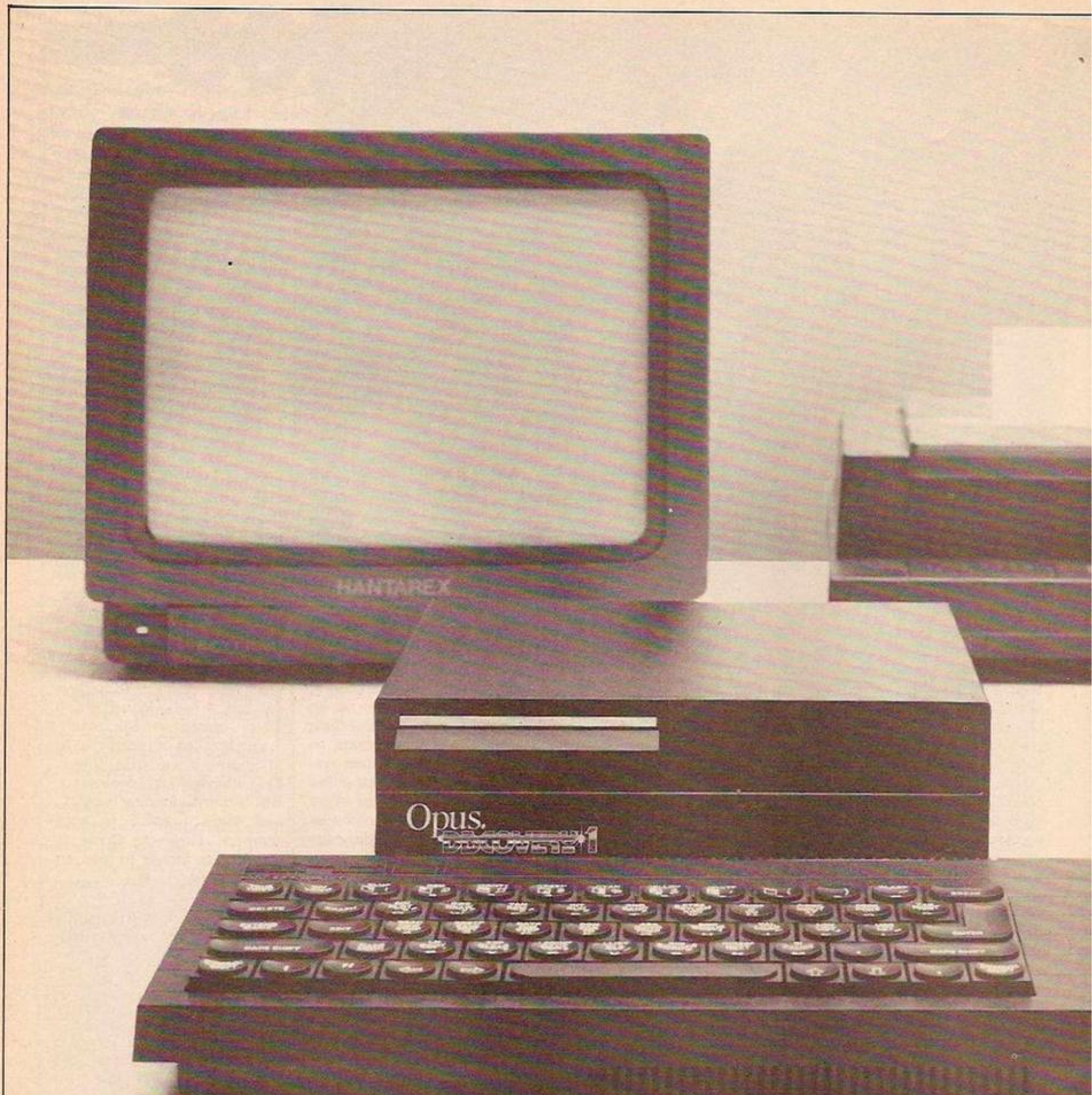
White Knight for the BBC.

The latest gimmick is of course 3D graphics. The quality will of course depend on the hardware available. I've seen one display where it was totally impossible to make out the pieces in a complex middlegame, making the display useless. On the other hand, the QL, which uses 32K screen memory — as opposed to 8K in the CBM-64 — can provide an excellent display which is a pleasure to use. Actually most of the recent attemps at 3D are much clearer and more usable.

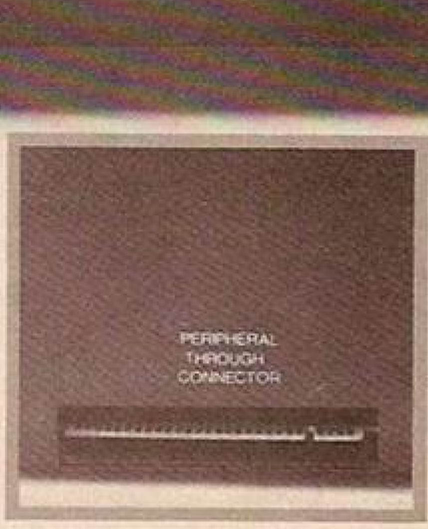
Loading times are generally much better now. Colossus Chess 4.0 uses a turbo-loader, Psion Chess comes on Microdrive, Superchess can be transferred to Microdrive if you want, White-Knight loads quickly because the BBC's normal loading is quick, and the program is very compact. However, Cyrus II Chess takes forever to load on the CPC-464. ●

Table 1.

Program / Feature	COLOSSUS CHESS 4.0	CYRUS II CHESS	PSION CHESS	SUPER CHESS	WHITE-KNIGHT MARK 12
Playing Strength	8	7	10	4	7
Graphics (overall)	8	8	10	6	8
3D	Y	Y	Y	N	N
Analysis display	10	5	7	9	9
Anticipate	Y	Y	Y	N	Y
Book (Size, on/off)	10	6	10	3	0
Display (Text)	10	7	10	6	10
Manual	10	7	7	3	10
Sound (Variety, use)	10	6	7	6	10
Alter-position	10	9	9	4	10
Back-Forward step	10	8	10	0	10
Blindfold play	10	0	0	3	7
Clocks	10	8	8	6	10
Colour (Adjustable)	10	0	2	10	10
Force move	Y	Y	Y	Y	Y
Joystick move entry	Y	N	Y	N	N
Legal moves display	Y	N	N	N	Y
Modes-of-play/Levels	10	3	6	5	8
New-Game	Y	Y	Y	Y	Y
Next-best move	Y	N	Y	N	N
Orientation change	Y	Y	Y	Y	Y
Play self	Y	Y	Y	N	Y
Printer	N	Y	Y	N	N
Problem Solving	10	5	8	3	7
Replay game	10	0	7	N	0
Save/Load games	Y	Y	Y	N	Y
Supervisor	Y	Y	Y	N	Y
Volume/Sound (on, off)	10	0	5	0	10


HANTAREX
Opus.

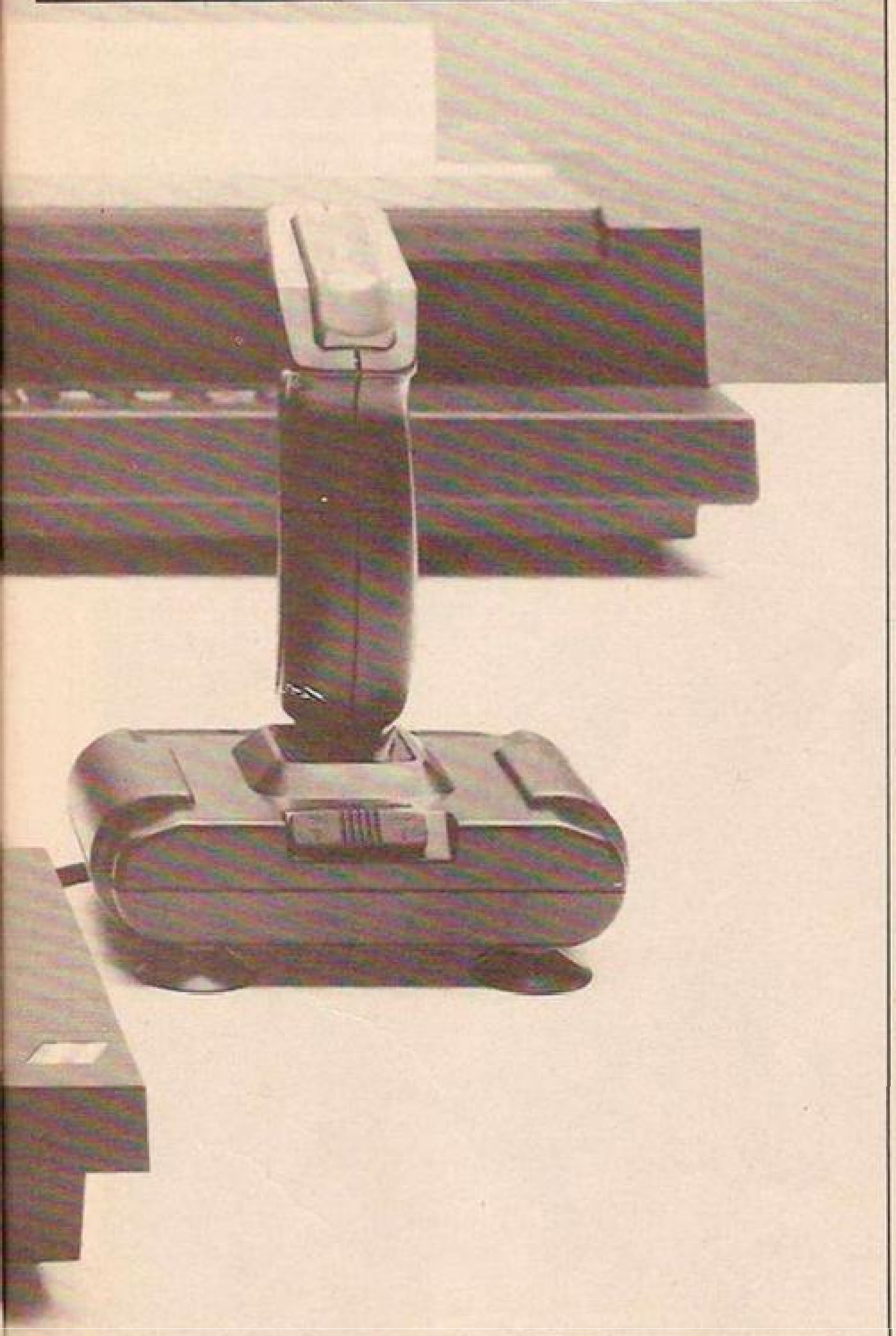

Opus.

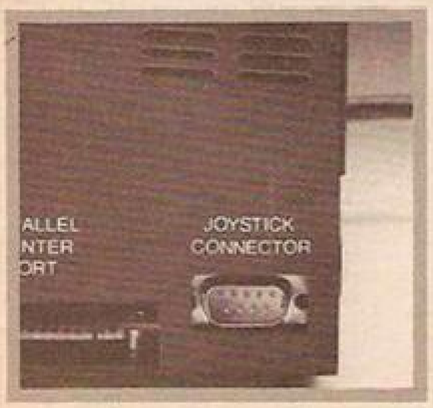

PERIPHERAL
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PARALLEL
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PORT


VIDEO
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TECHNICAL DETAILS
3.5" 250 K disc drive Double density disc interface Parallel printer interface Joystick interface Video monitor interface Peripheral through connector Built-in power supply Utilities on ROM including format and verify RAM disc facility Random access files fully supported Connections for second drive upgrade Comprehensive user manual
Total: £199.95 inc. VAT







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Discovery – helps your Spectrum make all the best connections for only £199.95

In one simple step you can now transform your Spectrum into a complete computer system. Discovery from Opus Supplies is a sophisticated computer nerve centre combining not just a powerful disc drive and double density disc interface but the most comprehensive range of interfaces capable of running printers, monitors, joysticks and other peripherals.

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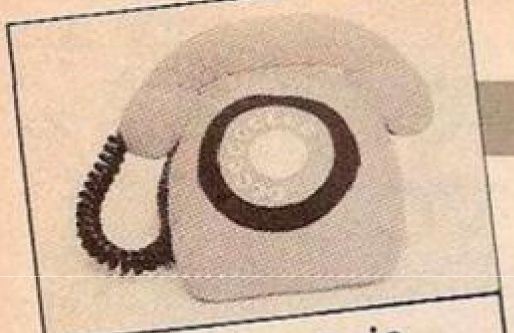
Discovery is available nationwide from Boots and from all good computer stores across the country. Ring us now on 0737-65080 for details of your nearest dealer, or to order your Discovery.

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*Price quoted refers to Discovery unit only.

Opus. Opus Supplies Ltd.

Opus Supplies Ltd,
55 Ormside Way,
Holmethorpe Industrial Estate,
Redhill, SURREY RH1 2LW.



This program is available on Telsoft.

Cheekah's

J. R. E. Wood and a platform game with a difference.

Picture yourself as a guy
with a top-hat,
With pulsating globules,
and bushes of green,
Something comes near you, you follow quite slowly,
A guard which moves like a machine,
Platforms of brick that seem so long and high,
Towering over you head,
Look for the exit to plan your escape,
And you're gone..

So sets the sceanrio for Cheekah's Exploits, a platform game for any Spectrum. It's main features are.

- Smooth, bright, fully animated graphics.
- Collapsing platforms — fully disintegrate as Cheekah walks on them.
- Brick platforms — Cheekah cannot pass through these.
- Touch sensitive conveyer belts — only operated when Cheekah walks on them
- Thistles — to be avoided.
- Mobile guards — move horizontally or vertically, kill on touch.
- High-score table.
- Attract mode.
- Continuous tunes.
- Editor mode — allows you to design new screens or change existing ones.
- 25 different screens — some fairly easy, others virtually impossible.

To enter Cheekah's Exploits, first type in the hex loader in listing 1. Run it and enter 0 for the line number. Type in each line of hex — the line of numbers and letters following the three digit line number — shown in listing 2. The computer takes a couple of seconds to process the data in each line. If the line is OK, it will be printed up on the screen and you can proceed with the next line. If you hear any of the three warning tones, then you have not entered the line correctly — enter it again. Once all the code has been entered the computer will Save it automatically.

Run the hex loader again, proceeding as before, except this time enter the lines in listing 3. Obviously, entering this amount of code in one go is no pleasure trip, so if you want a break, enter X and the code entered so far will be Saved. Make a note of the line number reached so that you can enter this in response to "Line number?" once you have reloaded the code and hex loader.

Now type in the program in listing 4 and Save it on another cassette, using:
SAVE "CHEEKAH'S" LINE 0

Then New the computer and lower Ramtop using:
CLEAR 23999 Reload the first block of code using LOAD "" CODE 32300 and Save part of it on the second cassette using: SAVE "EXPLOITS" CODE 32300,415.

Load the first block again, using: LOAD "" CODE and Save it over the original using SAVE "CODE" CODE 28415,4018

Load this block of code again, using: LOAD "" CODE 2400 and then the second block, using: LOAD "" CODE 28018. Finally, Save the main block of code on the second cassette using: SAVE "C" 24000,8440.

If you would like a copy of Cheekah's Exploits on a high quality computer cassette together with an instruction sheet explaining how to design new screen, send a cheque or postal order for £2.90 to: J. R. E. Wood, Northampton Hall, Bunhill Row, London, EC1Y 8LJ.

Listing 2.

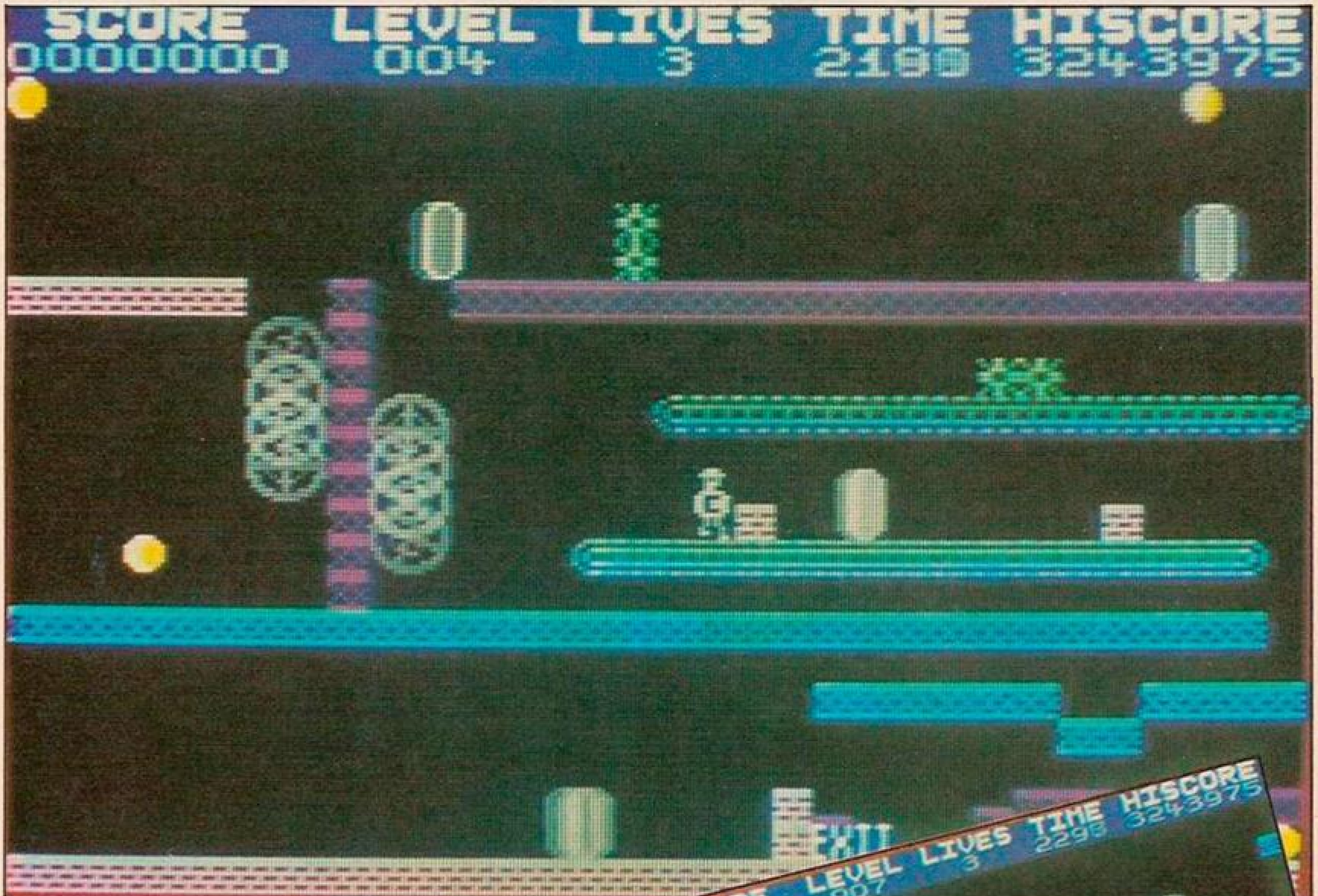
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Listing 1.

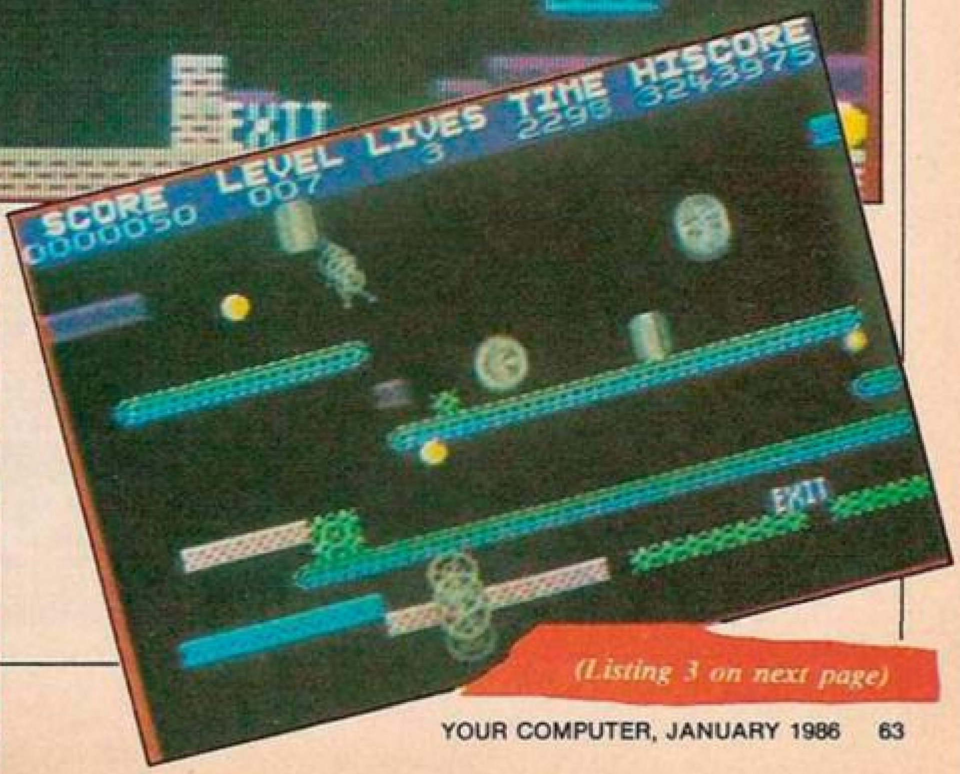
```
   10>DEF FN f(g)=a$(g)<"0" OR a$
(g)>"F" OR a$(g)>"9" AND a$(g)<"
A"
   20 DEF FN h(g)=CODE a$(g)-48-(
7 AND a$(g)>"9")
   30 CLEAR 27999: INPUT "Line nu
mber? ";l: IF INT l<>l OR l>340
OR l<0 THEN BEEP .3,0: GO TO 30
   40 FOR a=l TO 340
   50 POKE 23658,8: INPUT "Enter
line ";(a);":"' LINE a$: IF a$="
X" THEN GO TO 100
   60 LET c=0: IF LEN a$<>28 THEN
 BEEP .2,0: GO TO 50
   70 FOR b=1 TO 28 STEP 2: IF FN
 f(b) OR FN f(b+1) THEN BEEP .2,
-10: GO TO 50
   80 LET d=16*FN h(b)+FN h(b+1):
 LET c=c+d: POKE 27999+b/2+a*13,
d: NEXT b: LET c=c-d: IF d<>c-25
6*INT (c/256) THEN BEEP .2,10: G
O TO 50
   90 PRINT "0" AND a<10;"0" AND
a<100;a;" ";a$: NEXT a
  100 SAVE "CODE"CODE 28000,a*13
```

Listing 4.

```
   10>CLEAR 32299:LOAD ""CODE :
CLS : PRINT USR 32614
```







(Listing 3 on next page)

Cheekah's exploits

Listing 3.

```
000 07074FED43105BCDA36DCD696772
001 E1C93010087AB837C07BB9D8082F
002 81BBD8911680C9087BB937C07AB1
003 B8D80880BAD8901600C911C0604A
004 CB5E2003114061790F26000F0FCA
005 0FE6606F19EBC92A2B5BED52C949
006 21045BE5CD2F69E135C83A215B5E
007 FEFD28F2C92A2D5B46234E78B776
008 20142A295B23237EB7C8236E671D
009 CD0C69CBFE2CCBFEC9CD446D084F
010 11345B1AE67FFE03200600CB7790
011 200108E02B35ED281A131ACB7F40
012 28073CFE8420073E033D20023EF2
013 8012E67FC60EC3956823AFBE2843
014 211826CDBA68CD466C010503592F
015 CDEC6821175BCB8ECBBE210E5B20
016 AF77233605321F5B2A295B232324
017 2323222D5B21335B361323360344
018 C93A045BB7C8CDF76621346201C3
019 0700CD0B672A135BAF32045BC0E1
020 7E68D5C51CAFCD9568CB7A20027C
021 0D041D20F3C1D1C9210E5B34CB25
022 9621685B3A305BB7C8475E23C548
023 46234E2378CB7B280179BE20021A
024 CBC323BE2002CB83235623CB7BC1
025 280435203E72E52B2B2B2B2B2B18
026 73C5CB7B280CCB4320040D0D1816
027 170C0C18133E100F1520FC80CB33
028 4320049090ED44473A0E5BF523BA
029 702371D5CD5A67D1F1C13DCD5A4E
030 67E1C123109CC921125B35F5CD26
031 3768010A011E0ACDEC68F1C921CF
032 B062CDA56921000022 0A5B220CC3
033 5B3E0432175B3C32125BC9DBFEBE
034 2FE61FC93EF7CD2A6F20073EEFEC
035 CD2A6F280BAFCD2A6F20FACD2ABF
036 6F28FB3EFDCD2A6F20063EBFCD23
037 2A6FC821175B7EEE0477C91E03C5
038 0F3814CB5ECB9E200CE5CDE16F1B
039 2DCDF06FE1C80D0DBFC90F3813FE
040 CB5ECBDEC8E5CDE16F2CCDF06FF4
041 E1C80C0CBFC91D20D0C9CD0C6961
042 7EFE07C8FE06C8FE03280FE63F74
043 FE05200522315B37C97EFE18C933
044 C5D5E5CD5171CDC166D51A141419
045 B728FAE17CC60767924704280F7E
046 5415151A77251510FA702570E139
047 1806702570E13607D1C137C9794C
048 0F0F0FE61F6F780F0F0FE61F67B2
049 C979E607C0CD0C693E17BEC8111D
050 200019BEC878E6072002BBC919E3
051 7EFE17C9ED4B105B78B7C821172E
052 5BC5C5CDA36DCD6967CDD26DC12C
053 110F5B1AFE08304278FEB0282D86
054 E6072039CDE16F2424CD916F0880
055 79E60728062CCD946F381508381D
056 1221175B1AFE05206DAF321F5BAA
057 3E02CBE618653E05123A1F5BFE75
058 283606CD2168C31F7121175B1ABC
059 FE05204BCBA6E52A315B7CB57E29
060 E1280ACB77CC636FC47A6F181BD3
061 7E1F38273EFBDBFECBEFCD5E6F62
062 300C3EDFDBFE17CD5E6F3002CBE0
063 E6CB4620753EFECD2A6F20073E93
064 7FCD2A6F2867AF321F5B3EFB1820
065 06CB76CBF62803CBB63C320F5B8C
066 3DFE0428883CF58047F1F5E5CB7D
067 7F2007211F5B8677182878FE1004
068 3016CDE16FCD0C697EFE17280B73
069 79E60720132C7EFE17200D2117C5
070 5B3E40AE77E1F1ED4418BEE1F1A9
071 CB66200ED17BB9D52008CB5ECC56
072 696FC47F6FD179FEFA38014BED3D
073 43105B78BAF5E5CDA36DCDA0676B
074 E1CB6E280ACBAE01FF031E01CDB4
075 EC68F1C62A115B1103006229296B
076 C35E697DE61F4F7CE603477DE66A
077 E0B007070747C93A0E5B4ECB71E2
078 2804D603ED4447043E0FC60310A7
079 FC5F2C7DE61F28047EB928F650DA
080 2D2D147D3CE61F28047EB928F4AB
081 2CCD51717E21000022315BC37E49
082 6B219977ED5B2B5BCBBECDA96BD4
083 ED521920F6C9CDD0663E013207B2
084 5BCD7569110907CDE56621B8657D
085 22055BCD206F21106622295BCDE0
086 466C3E0D32175BCD3F6E21336302
087 CDA569CD4C722805CDF26918C598
088 063E02CD7569CD9D710830082132
089 010022135BCDEE7518AECD116FD4
090 CDD066CDF66B7CB5CC346C381016
091 EBCD1C6C380ACB7E2808214E62CF
092 CD376CCDC06D18E1CD4972D2AF6C
093 712A295BCBFE219977ED5B2B5BE7
094 CB7E28C8CDA96BED521920F4CD53
095 9D7118B8CD2B6ECD1A673A175B41
096 CB4F2806CDFF6ECAD36918EBCB58
097 7F28111FD8ED5B155BCD486601E5
098 01011E0AC3EC68CB57C47D69CDDA
099 1A67CD8B6ECD1A67CD0D70CD1AC6
100 672A315B7CB5C462713A175B1FB0
101 300DCD1B697BFE0FC8FE1C37C8F7
102 18AACD306FCD12683EFED8FE1FA9
103 389D3E7FD8FE1F3896C9CDD06624
104 21175BCBC6AF32185B11070FCD6C
105 E56621DC610100017E23087ECD9F
106 95680C0C2379FE1E20F1210F0819
107 22085BC3AE73CD2F692A085BE540
108 CD0C69CBBEE13A215B5FFE0620E5
109 057D8728012D7BFE0920067DFEB2
110 1F28012C7BFE08200425200124B3
111 FE0720067CFE172801242208 5B8E
112 E5CD0C69CBFEE13A215BC92A29A3
113 5BE5CDA96BEBCDBA6D444DEBD14D
114 2802EDB0ED532B5BD1D1D1D1C99A
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117 E0FE32CC8D74FE2B2012CDC4743D
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123 3A185B076F2600097EF640082331
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227 002E300F9EC21000D111B5B2284E
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229 8B0E23004C950B9600B6F2B3B24B
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234 9400E260F605B09445B994AAB203
235 96D2AC92001602141206120E1822
236 091F0D14050E07170044A60064C8
237 51268200AFB2CE99AE922D9EAC78
238 B24B920B86AAB286B3A5B22D92FB
239 ED9556A5A82DA827099E6792E7C8
240 98A8B20093B2B7B2000B9F0D9DF4
241 0B9569B200F112B3B5723362C0ED
242 79000D0E0D0F1601161E020E020D
243 110C020C1D0309030B0314031692
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247 8E6B8E238F4B014B1E00228F0BAA
248 920B8D0395038A00ED9422101B1D
249 96100396ED622100160117 1E02FD
250 090E040F030801061C0216000072
251 85E152E28D02EDC36AE1483D512A
252 A3B1AFE796C781E78B64E2A52045
253 00ED016D1CA73E4714470973007A
254 255F00000E8300E2AA2AE521F0C1
255 E8CAA1EEC5550002180216 0B0098
256 0517151716161618130202 1F00D8
257 005796004696007 69C9495928E24
258 90878E808C878A8E8095669C44B3
259 96000596059816970B8900024556
260 D0424CD08253D0C25AD0EC400CF7
261 A80F868FC39ECFC09E0012051485
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264 809485B28AB4908D8500028100AE
265 E5A0B1A5CEA968E060025CCE4B71
266 6B950E4692EF408CF5606B8290A3
267 9200031F14000200141F090B091A
268 140D170D081104111B0000F7E065
269 678EB3C5AFA9EB8C0000A5B2A538
270 A00000424F8CA96C9AED29B1F124
271 45538500F800151F031E031B11C9
272 06111011141 11E070300D76000BC
273 A5A2A5B26BE4E521C2E148E200C0
274 2790AEE2AF07AF08AF0EAF0FAFDE
275 15AF16AF1CAF1D00179F624000C9
276 00F57817F59196F5AA15F5C394A0
277 A34163A924EA0003001319020C3B
278 0217101E141F00D261C5E089633E
279 0052A022ADE298C6E0001600368D
280 8FAD96651F003687358BAD81CDCE
281 8B1098001780378F7411740E0097
282 F08155E7807653778E537B8E0057
283 160F031B041304160C100502069D
284 03070207160A1600702000A49916
285 A799AA99AD9900E23F02200096A2
286 B254C18B004F8C0681C5332BC198
287 00068200E814A7EB1427C2A99C58
288 EE6125A5142700160213010F0291
289 08130C18101D00D60800E40F2E6B
290 2F079000C4A0149F128E00868083
291 88858A8A90808990AA325D952E76
292 37919AB21CAE80B2802C873487FE
293 000F810F830044769D84FB2DEC11
294 4090E200B602F11400021B1200A0
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297 C41B8D9B8D80ADA900C401C402F5
298 C403C41CC41DC41EA40DA40EA471
299 0FA410A411A4125090D28D6C8861
300 6C940042384227A413A40C90B38D
301 D58D00EC8C8206350A351600AB99
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303 BA00021F0B05071C0703151A0E55
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307 B58D00289707982707088800AF0D
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309 93B3188F000412021E0809006A9E
310 9B269600369034 8E328C308A2E85
311 88002E3FC4A300869BA68D8AAAE4
312 8222822100258F00E8AA95A8D19B
313 12429996066C958B70A500151E64
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315 ED807734762100C4C1A49A8781AA
316 E7C636130000A240CAB1AAA12BCB
317 8F0037A23588358400E5016A4F7D
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323 860C84000B85EE12EE140E930049
324 F28B8F4E2A9EA3E224001517163D
325 1E0A19161D0C010068402D9700ED
326 24C10070C0659349972D9D00F7AE
327 E0B100B101A912A9138200005490
328 1AEDA200E221F4916A92A641C5D9
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330 49864990479347892C9B498C8876
331 96002F84C82000358147 8000ED9B
332 88ED950002418C02498C424C94D2
333 025690425194425BA002538C426F
334 599042479400151F0402101A0670
335 0A06130073E26BE100F7E00D8028
336 E681A68CE69500861E001580AFFC
337 E0319E003105328A3110329700A8
338 F59913B58312750D12352711F511
339 8110ED8194AD68956D4F962D36F2
340 9700000000000000000000000097
```







EPYX MAKES EVER

SUMMER GAMES

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- **Opening Ceremony and Awards Ceremony.**
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- **Individual and Team play.**
- **Joystick Controlled.**
- **One or more players.**

Available for:	
Commodore 64 Cassette	£9.95
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SUMMER GAMES II

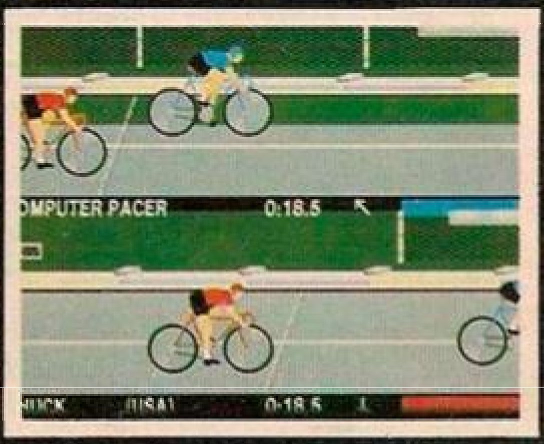
Compete with up to seven other contestants in your favourite individual event, or go for it all in the grand competition. Some events, like cycling, rowing and fencing even challenge you with realistic head to head competition!

You have a choice of eighteen countries to represent and you will need the correct strategy and mental toughness, not just speed and agility to excel in each of the eight events. That's why we included a feature that lets you practice each event until you're ready for the real competition.

Remember, it's not too early to get ready for 1988. With the right diet and training you might just make it; but in the meantime grab your joystick and try eight new ways to go for Gold!

- **Includes Cycling, Fencing, Kayaking, Triple Jump, Rowing, High Jump, Javelin & Equestrian Events.**
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- **Individual & Head to Head Competition.**
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BREAKDANCE is more than a game, it's four games in one. In the first you "go down" to "battle" row after row of breakers as they attempt to invade your turf. A second game lets you "break" with the famous "Hot Feet" in a contest to see who really has the most "juice" in town. A third challenges you to figure out the right sequence of steps to perform a backspin or suicide without getting "whacked." Or, you might want to start with the free-form section where you choreograph your moves and watch the computer act them out in slow motion or at normal speed.

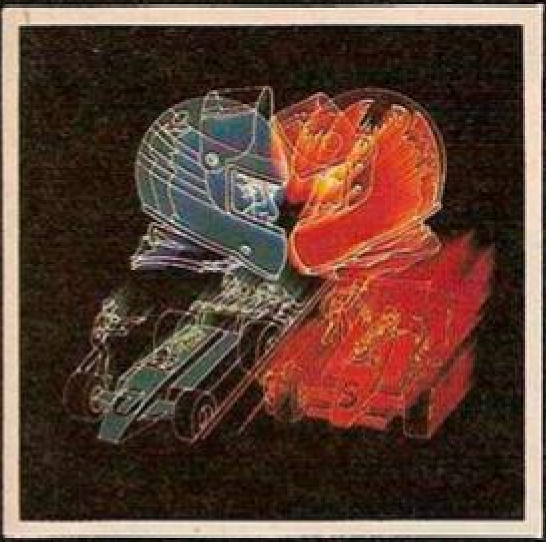
It's up to you, play it alone or against a friend either way...Breakin' is now made easy with BREAKDANCE!

- **Over 100 different steps in all.**
- **Complete with breaking music.**
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Introducing true competitive auto racing, both on the track and in the pits.

A split screen display allows two players to race against each other, fighting for the lead on the track and struggling to be first out of the pits.

You'll need a race strategy good enough to beat an opponent. But remember, his strategy might be as good as yours. Then it comes down to a test of nerves, a test of guts.

Grit your teeth and hope that you tyres and fuel hold

PITSTOP II

out for another lap, because if you 'pit' now it may cost you the race!

- Head to Head Motor Racing.
- 6 Different Circuits.
- On Screen Map.
- Full Pit Facilities.

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Your mission is to foil a horrible plot. From an underground laboratory, Elvin, the scientist, is holding the world hostage under the threat of nuclear annihilation. You must penetrate his stronghold, avoid his human-seeking robots and find the pieces of the security code.

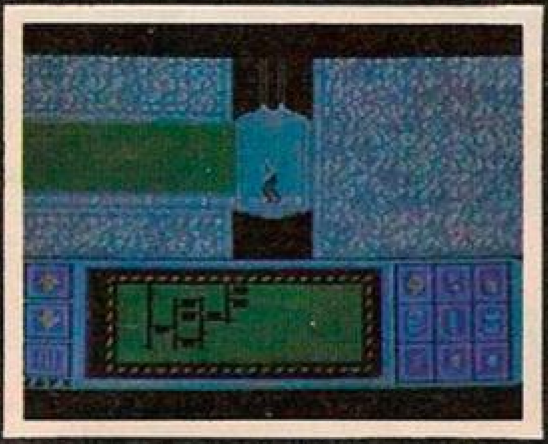
Somersault over the robots or use a precious snooze code to deactivate them long enough to search each room. Use the Agency's computer to unscramble the passwords from the code pieces, or

IMPOSSIBLE MISSION

try to solve them yourself. You've got to reach Elvin's control centre, but you'd better beware.... This mission is stamped IMPOSSIBLE!

- Over 30 Rooms.
- Over 80 Different Robots.

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You've captured the gold in Summer Games™ and Summer Games II™ — now it's on to the **Winter Games!** And what an incredible setting — a completely realistic winter wonderland featuring six action-packed events. You can compete against your friends or the computer.

First choose the country you want to represent. Then it's practice, training and learning a winning strategy for each event. Now the Opening Ceremony and the competition begins. Will you be the one who takes

WINTER GAMES

the gold at the Awards Ceremony?

The quest for the gold continues. . And it's all here — the strategy, the challenge, the competition, the art and pageantry of Winter Games!

- Six Winter Events: Bobsled, Ski Jump, Figure Skating, Free-Style Skating, Hot Dog Aerials and the Biathlon
- Opening, Closing and Awards Ceremonies complete with National Anthems
- Compete Against the Computer or Your Friends and Family

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Spectrum 48K Cassette	£7.95
Coming soon:	
Amstrad Cassette	£9.95
Amstrad Disk	£14.95



Robot

Figure 1.

```
40 PROCINITIALISE
50
60 R = 2: D = &FF
70 PROC_OUTPUT(R,D)
80
90 R = 0: D = &F0
100 PROC_OUTPUT(R,D)
110
120 END
130
140 DEF PROCINITIALISE
150 OSBYTE = &FFF4
160 ENDPROC
170
175 DEF PROC_OUTPUT(R,D)
180 A% = 151
190 X% = R + 96
200 Y% = D
210 CALL OSBYTE
220 ENDPROC
```

John Dawson looks at Milton Bradley's Robot kits.

The Robotix kits from Milton Bradley are a new addition to toy shop shelves. Each kit contains plastic beams, wheels, bearings and trimming pieces that allow you to build any number of different moon buggies, asteroid scanners, dune detectors, and star crabs; as well as more mundane cranes, lorries and "walking" machines.

The heart of the system is a small, but very tough electric motor. The smallest kit has one motor and the largest has four. Each motor can be controlled separately by a manually operated switch and will turn clockwise or anticlockwise.

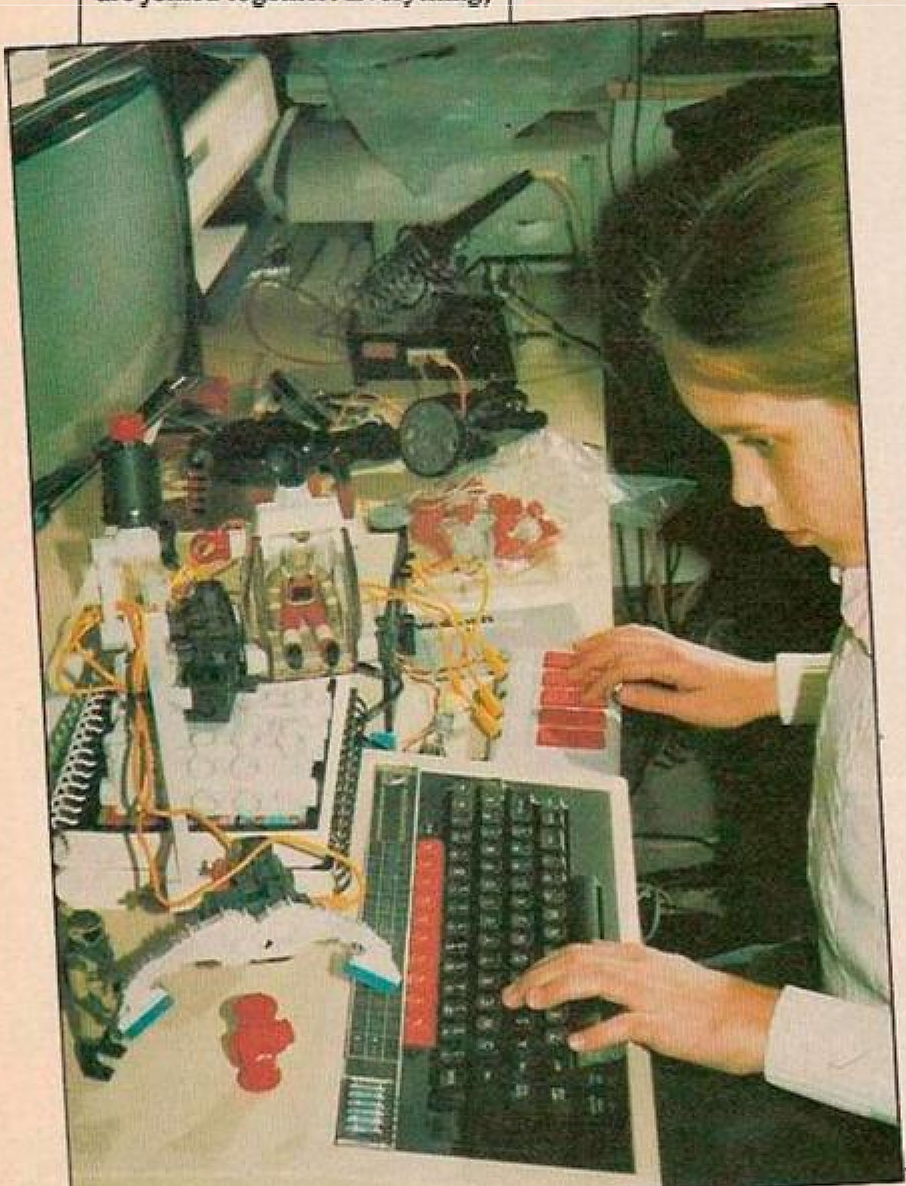
The second key element in the design of the system is the hexagonal plug and socket method by which different components are joined together. Everything, from axles and swivel joints, to beam and gears, uses the same six-sided connections. Both Fischer Technik and Lego have produced construction kits that can be used for serious computer-controlled projects and the different methods have advantages and disadvantages.

Fischer Technik components lock precisely and solidly together but the gear will rely on friction between the axle and the wheel to transmit force. Lego plugs together less decisively than Fischer Technik but its gear trains use axles with splines to hold the gears rigidly in place. Neither system is inadequate provided that you stay with the forces with which it was designed to cope.





Above: Milton Bradley Robotix motor.
Below: Controlling the arm using a BBC micro.



In the same way the Robotix system relies on a tight push fit between the male and female components of the connectors if useful loads are to be supported and driven.

The Robotix motors are about 5.5 by 3 by 3 cms in size. An output shaft emerges from one side and there are connectors on four other sides of the obling casing. The motor can be mounted so that the output shaft rotates in any one of three axes. The unit is powered by three volts DC and incorporates a 1300:1 reduction gear train.

When it's running free with no load the shaft rotates at about six revolutions per minute (rpm) so the motor itself is rotating at about 7800 rpm. Milton Bradley say that there is an integral clutch inside the casing which prevents damage if the motor is connected to the two arms to make a "hand" for holding objects.

Motors are impressive

Using fresh batteries I measured the free running current taken by the motors as approximately 60 mA. On load the current rose to about 180 — 200 mA and when the motor was stalled, that is with the output shaft stationary, the current rose to around 400mA. There seemed to be about two or three degrees of play at the output shaft which is not surprising given that there is a substantial reduction gear train between the output and the motor. The maximum torque is said to be 3.5 kg/cm. In other words the motor will lift 3.5 kg on a lever one centimetre long fixed to the output shaft. If the lever is made longer, the weight that can be raised is reduced. At five centimetres — about 2in. — the motor will raise a weight of 700 milligrams, roughly 1.25 pounds.

The motors, made in Hong Kong, are very impressive pieces of cheap mass production engineering.

The instructions in the Robotix kits are based on photographs of completed models with a list of the parts required printed at the side. The photographs are very nice but not particularly easy to follow if you want to slavishly build one of the Milton Bradley designs. Leaving that aside, the kits offer enormous scope for constructing working models that are both fun and instructive.

I had intended originally to use the Fischer Technik robotics kit to illustrate how you can build an interface between a microcomputer and a device that you wish to control. However, the Fischer Technik kits are expensive and difficult to obtain from local toy or model shops. The Robotix kits are marketed widely and you get more motive power for your money.

What the Milton Bradley kits lacks are the sensors like

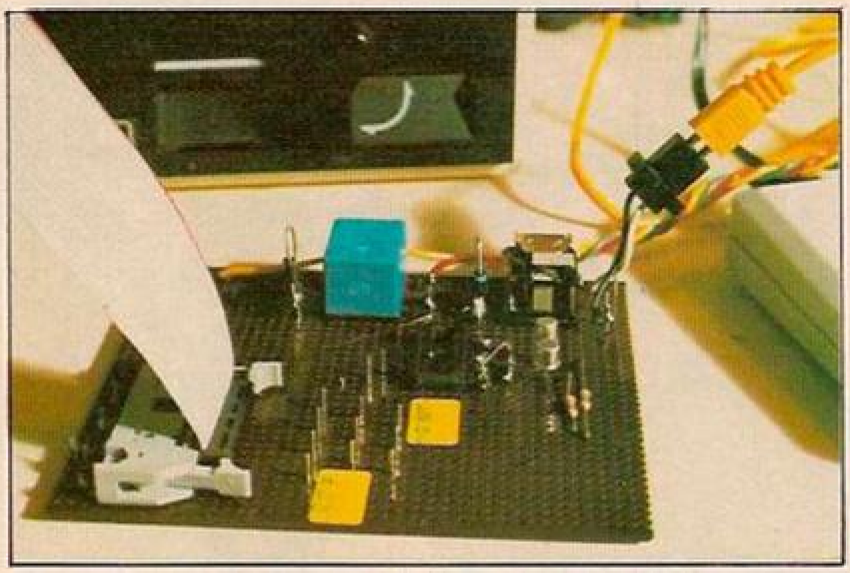


Figure 2.

```
40 PROCINITIALISE
50 PROC_OFF
60
70 REPEAT
75   PRINT TAB(10,5); "PRESS  Up  Down  Quit  Stop (Space bar)"
78   PRINT TAB(10,7); "Status ";
80   K$ = GET$
110   IF K$ = "U" THEN PROC_OUTPUT(0,&01): PRINT TAB(19,7);"UP      "
120   IF K$ = "D" THEN PROC_OUTPUT(0,&02): PRINT TAB(19,7);"DOWN    "
130   IF K$ <> "U" AND K$ <> "D" THEN PROC_OFF
140   UNTIL K$ = "Q"
150
160 END
170
180 DEF PROCINITIALISE
190 CLS
200 OSBYTE = &FFF4
210 R = 2: D = &FF
220 PROC_OUTPUT(R,D)
230 ENDPROC
240
250 DEF PROC_OUTPUT(R,D)
260 A% = 151
270 X% = R + 96
280 Y% = D
290 CALL OSBYTE
300 ENDPROC
310
320 DEF PROC_OFF
330 PROC_OUTPUT(0,0)
340 PRINT TAB(19,7); "ALL OFF"
350 ENDPROC
```

Far left: Unpacking the pieces. Left: The interface. Below: The "hand" made out of two opposed "fingers" driven by a motor.

microswitches and photocells that are easily availabled for Fischer Technik, and also some of the precision that can be achieved using Fischer Technik components. The first problem can be overcome and the second may or may not matter to you.

Figure 1 is the original porgram that I typed into my BBC microcomputer to control the lines from the user port. The program was copied from *Interfacing and Control on the BBC Micro* which is a National Extension College publication — ISBN 0 86062 400 4. Figure 2 shows how the program developed to show on-screen the status of the interface, and to obtain an input from the keyboard which will switch the interface to move active state — moving up — to a second active state — moving down — or to an inactive state — both outputs off: all off.

Principle is quite simple

The principle of the program is quite simple although the chip involved in sending the data to the interface is almost as compex as the 6502 central processor unit itself; it is certainly less well understood by most people.

The uses of 6522 Versatile Interface Adapter (VIA) are described in the Advanced User Guide to the BBC Micro, *6502 Software Design* by Leo J Scanlon — ISBN 0 672 21656 — and several other books about the 6502 microprocessor. For these purposes the 6522 VIA can be treated as a simple input/output chip which takes data from a memory location and outputs this information on the eight data lines.

The output lines coming from the user port continue to hold their on or off status until new information is written into the memory location.

The superb machine operating system in the BBC micro makes everything easy in both machine code and Basic. Price Output — lines 250 to 300 in figure 2 — sets up an Osbyte call which will write to one of the memory locations associated with the user VIA. The "memory location" is actually one of the registers in the 6522 chip which is treated as through it were part of the computers ordinary Ram. Initialisation is carried out by sending Data &FF to Register 2 in lines 210 and 220. This sets up all the eight data lines as outputs rather than inputs.

Proc Off transmits 0 to register 0 which sets all the output lines to off, that is about zero volts. When a line is set to On the voltage rises to more than 2.4 volts in theory and a little less than the 5 volt supply in practice — 4.8 volts typically.

A line is turned on by setting one bit of the data byte to a one instead of a zero. Remember that each byte has eight bits:

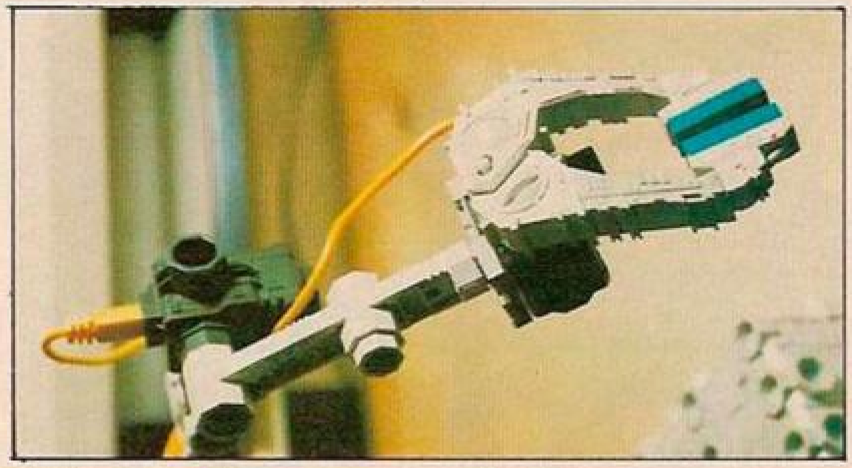
0 0 0 0 0 0 0 0
7 128 64 32 16 8 84 2 1

one byte shown as binary bits
bit number
value of each bit in decimal

So the byte shown above has a decimal value of four. I have used the two lowest bits to control two lines from the user port and these are turned on by writing either &01 or &02 to the VIA register. Programming books will show you how to twiddle individual bits using the various Boolean operators - And Or Not XOR. If you want to control each data line independently you will need these techniques because the only alternative is to turn off all the lines at the same time by sending &00 to the VIA.

More than one process

The advantage of controlling each line separately is that it permits you to have more than one process operating at the same time. For example, you may wish a robot arm to turn clockwise while the wrist joint is also extending to position the object it is holding correctly before it is placed at its destination. If the wrist turning movement is completed before the rotation you must turn off the wrist motor or actuator while the other continues to run.



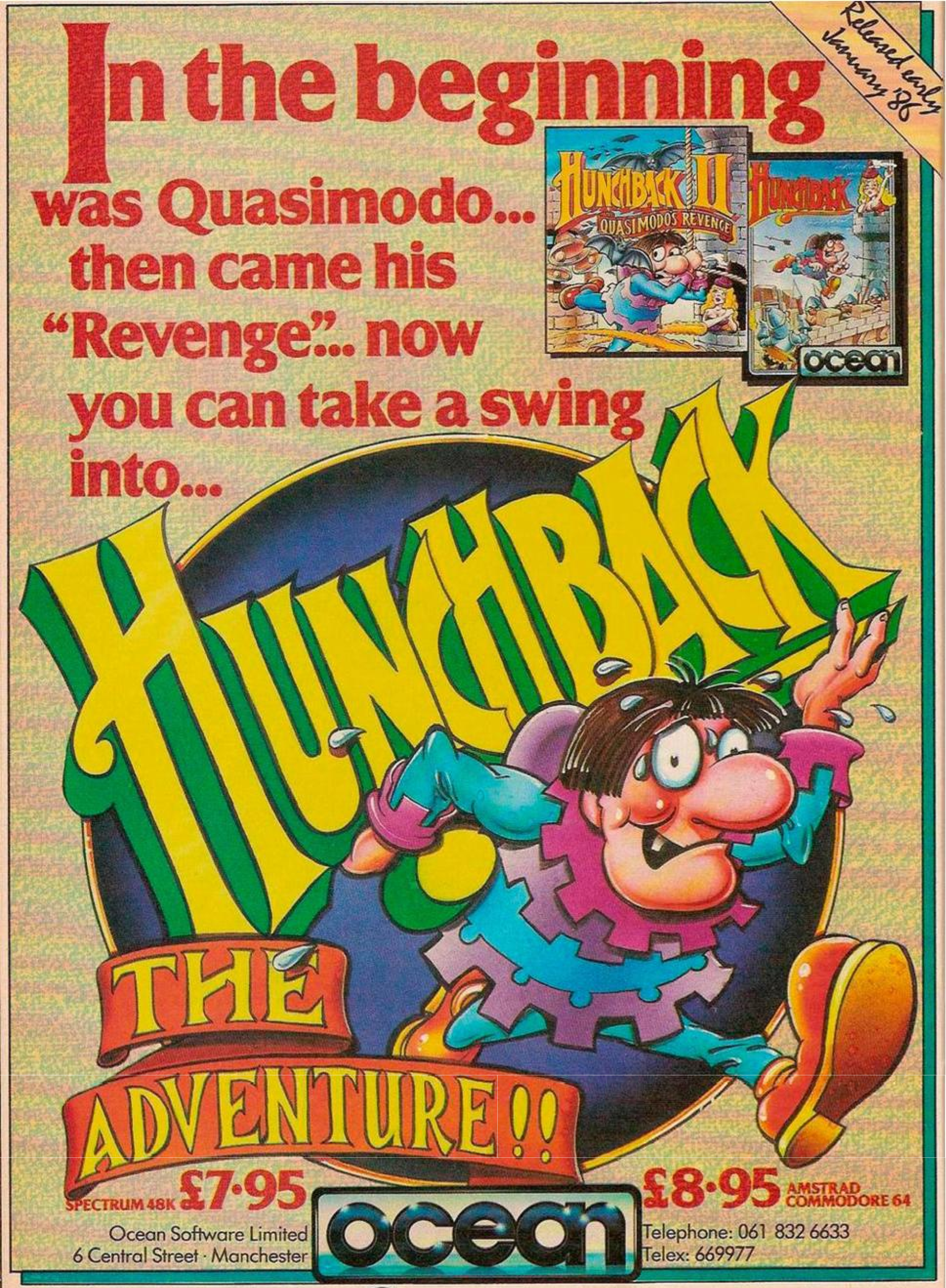
It doesn't matter that the software that you use to start controlling a robot is very simple. There is a sense of wonder when you press a key on the BBC micro and see this translated into a movement of something that you have built. The excitement of making the first steps will lead you quite certainly into developing more complex and capable software.

The electronics of controlling a robot or some other machine can be as sophisticated or as simple as you like. The interface that I built is very primitive indeed but it works and could be developed further.

Most of the components for the interface came from the local Tandy shop. I don't like going to Tandy's particularly because their electonic bits and pieces are more expensive than they should be, but otherwise you may have to order what you want by mail. You will need a lead to plug into the BBC micro user port — 20 way ribbon cable and one, preferably two, 20 way insulation displacement plugs — IDC plugs. I used a small piece of Veroboard to mount the interface components and bought a 20 way socket to connect to the remote end of the lead from the BBC computer.

The VIA in the computer will not drive the motors in the Robotix kit directly. The reasons why not, and some commercial alternatives to doing it yourself, are well explained in Richard Pawson's excellent book *The Robot Book* published by Windward — W H Smith and Son Ltd — ISBN 0 7112 0413 6. I decided to use

(continued on page 71)


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then came his
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you can take a swing
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Robot kits

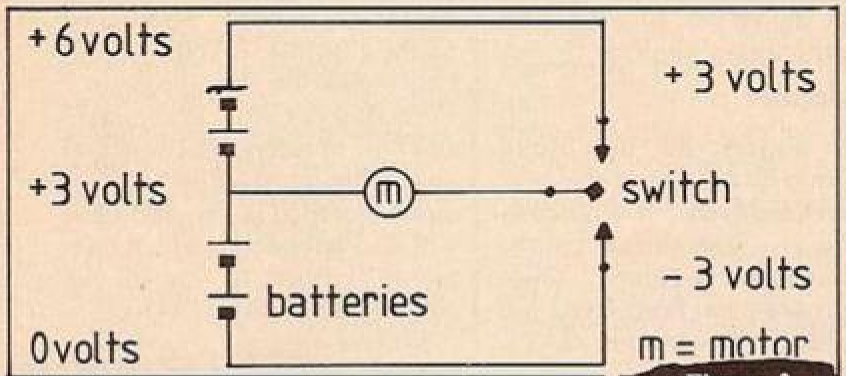


Figure 3.

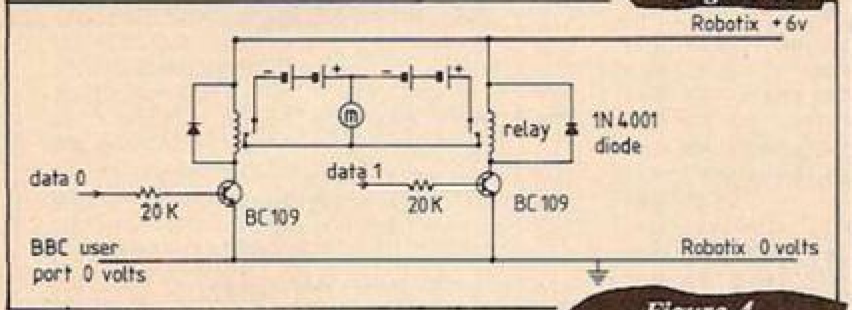


Figure 4.

(continued from page 69)

ordinary relays to switch the motor power supply because they provide good isolation between the electrically noisy motor circuits and because they make reversing — rotating the motor in two directions: forward and reverse — far easier than doing the same thing using transistors.

The circuit diagram of the original Robotix switches is shown in figure 3. You can see that one side of the motor is connected to the middle of the four 1.5 volt batteries. Pressing on the rocker switch connects the other side of the motor to either end of the stack of batteries — 3 volts positive or 3 volts negative — which makes the motor rotate clockwise — forward — or anticlockwise — reverse. When the switch is left untouched it is not connected to either the positive or the negative supply.

The interface is designed simply to replace the two actions of the switch and figure 4 shows the circuit diagram. The test version that I built and that is shown in the photographs can control only one motor. You can control four motors using eight relays by duplicating the circuit and connecting each input to a transistor to one of the data lines from the user port.

Alternatively, you can use some of the data lines to switch other devices like electromagnets for lifting things, light bulbs, solenoids to open or close gates, and motors that have to turn in one direction only. Darlington transistors — the TIP 120 and TIP 125 are typical — can be connected to the data lines and, because the transistor has a very high gain of more than 2000, can control directly a Direct Current (DC) load of up to four or five amps at 50-60 volts. So, if you have one or two motors in the Robotix kit these can be supplemented by other devices that you make yourself.

The 20K Ohm resistor — 20,000 Ohms — between the user port line and the base of the transistor prevents an excessive current being drawn from the VIA in the computer. The relay requires about 70 mA at 5 volts to operate reliably and the BC109 NPN transistor uses the voltage change on the data line to switch hard on and hard off, turning the relay on and off as it does so.

Any general purpose NPN transistor will do for this application provided that its maximum collector current is sufficient and that it has a DC gain of more than 60. The 1N4001 diode is connected across the coil of the relay to prevent a spike of reverse voltage which might destroy the transistor when the current through the relay is turned off.

I can never remember which way round diodes should go and for this application the band round the diode, which marks the positive end or anode, should be soldered to the side of the coil connected to the positive supply.

The batteries in the Robotix kit are used to supply power to the transistor/relay circuit. With the exception of the Tandy relays, the cost of the interface can be counted in pennies. You don't need the IC socket shown in one of the photographs, it was part of my experimenting with an opto-isolator on the way to the interface given in figure 4.

I guess that it will take you a little while to get over the thrill of seeing a buggy or a robot arm moving under the control of pressing keys on the BBC micro. But what would happen if the Robotix machine disappeared out of sight? You are responsible for every move that the machine makes and it's your eyesight that is closing the loop that runs from the BBC micro keyboard to the VIA, to the interface, to the motors, to your eyes and back to the keyboard through your fingers.

If the computer could detect when a robot arm had reached the right place, it could then take the appropriate action without your invitation.

Motors, loadspeakers and electromagnets are called "effectors" because they allow a robot to effect an action or movement. Position detectors such as microswitches, potentiometers, ultrasonic rangefinders and photocells, and other measuring devices like temperature probes are known as 'sensors' because they sense or detect information which can be used by the robot's computer to make decisions.

For example, a simple microswitch mounted at the front of a remotely controlled turtle or buggy can be made to switch on when the buggy collides with an object. The Adval command in BBC Basic can be used to detect the On/Off status of two input lines — intended originally for the fire buttons on joysticks — as well as to read the values of the four analogue to digital converters.

Related to the Milton Bradley Robotix kits, the Adval instruction could be used quite easily to read the position of four potentiometers monitoring each of the four motors in the Master set while one of the switched inputs could be connected to a microswitch mounted so that it is turned on when an object is held securely between the fingers of the motorised "hand".

No special electronics are required to couple the potentiometer to the A-D inputs.

Beyond this you can start to make up sensors and designs to suit you own purposes. For example, you may wish to weigh a number of packages as they pass along a conveyor belt.

The weight of the package, in terms of either too light or OK, can be detected by using rubber bands to bias a microswitch so that it closes only when the tension in the cord supporting the electromagnet is more than a certain amount. If the package is too light the arm can be used to lift it off the conveyor belt.

Wychwood, the plotter control program described in the October and November, 1985 issues of *Your Computer*, could be adapted without difficulty to work through a series of instructions to make a robot carry out a set process. ●

CONCLUSIONS

● The Robotix motor and "hand" lifted a solid glass ball about 1.5 inches in diameter. The ball weighed approximately 4 ounces. That was the heaviest object I tried to hold in the soft rubber palms of the plastic fingers. Six revs per minute doesn't sound very fast but the end of an extended robot arm will complete 90 degrees of rotation in 2.5 secs — quite fast enough if you are trying to position the hand over something you want to pick up.

● The design of the Robotix component is clever and it would be good to see a firm producing sensory add-ons for the kits. Flight Electronics have been marketing robotic equipment to connect to the Microprofessor range of computers.

● You won't make a fortune, I don't think, with a robot built out of Milton Bradley parts and run by your BBC microcomputer but you can't fail to enjoy watching a mechanism you have designed and built being controlled by software you have written.

Telsoft

The programs given here will enable Spectrum, BBC, and CBM-64 owners to download via *Your Computer's* Telsoft service. Each month for each machine we transmit least one — and usually two — of the main programs appearing in the current issue. Also available is the full user to user communications program Dialsoft.

So far OE LTD's Telemod 2 and the VTX 5000 modems have been tested with the BBC and Spectrum but the service also works with a number of other makes. For the CBM-64 it will initially only be available with the OEL Comms pack together with the Telemod 2 or similar modem; later we hope to adapt the service to work with Commodore's modem.

Hexloader

To enter the download program first type in the hexloader for your machine — figure 1 — and then enter the machine code — figure 2. Once the program has been saved you can run it by entering CALL &6000 on the BBC, SYS 51000 on the CBM 64, RANDOMIZE USR 60000 on the Spectrum.

To find out what is available and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bits/ services.

When a program you want to

Figure 1. CBM-64.

```
5 REM    HEX LOADER FOR CBM 64    FIG.1
6 REM
10 FOR I=680 TO 727:READA:POKEI,A:T=T+A
20 NEXT:IF T=6716 THEN GOTO 100
30 PRINT"ERROR IN DATA ";T-6716:END
40 DATA 169,1,133,186,169,1,133,184
50 DATA 133,185,169,8,133,183,169,208
60 DATA 133,187,169,2,133,188,169,56
70 DATA 133,251,169,199,133,252,169,251
80 DATA 162,231,160,206,32,216,255,96
90 DATA 68,79,87,78,76,79,65,68
100 SA=51000:LA=52855
110 INPUT"START ADDRESS";A
120 IF (A<SA) OR (A>LA) THEN GOTO 140
130 IF A/8=INT(A/8) THEN GOTO 150
140 PRINT:PRINT"ADDRESS ERROR":GOTO 110
150 T=(A-32768)AND255:PRINTA;:INPUTD$
160 IF D$="END" THEN GOTO 900
170 IF LEN(D$)=20 THEN GOTO 190
180 PRINT"WRONG LENGTH":GOTO 150
190 FOR B=0 TO 7:B$=MID$(D$,2*B+1,2)
200 GOSUB 300:IF E=1 THEN GOTO 280
210 POKE A+B,D:T=T+D:NEXT
220 B$=MID$(D$,18,3):GOSUB 300
230 IF E=1 THEN GOTO 280
240 IF T=D THEN GOTO 260
250 PRINT"CHECKSUM ERROR":GOTO 150
260 A = A+8:IF A<LA THEN GOTO 150
270 GOTO 800
280 PRINT TAB(8+2*B+D)C$"??"
290 B=8:NEXT:GOTO 150
300 E=0:D=0:FOR N=1 TO LEN(B$)
310 C$=MID$(B$,N,1):GOSUB 400
320 IF E=1 THEN D=N:N=4:NEXT:RETURN
330 D=D*16+X:NEXT:RETURN
400 X=ASC(C$)-48:IF X<0 THEN E=1:RETURN
410 IF X<10 THEN RETURN
420 X=X-7:IF X<10 THEN E=1:RETURN
430 IF X>15 THEN E=1
440 RETURN
500 H$="0123456789ABCDEF"
510 FOR A=SA TO LA STEP 8
520 PRINT A;"? ";:T=(A-32768)AND255
530 FOR B=0 TO 7:X=PEEK(A+B):GOSUB 600
540 T=T+X:NEXT:PRINT"=";
560 Y=INT(T/256):PRINT MID$(H$,Y+1,1);
570 X=255 AND T:GOSUB 600:PRINT
580 NEXT:GOTO 900
600 PRINT MID$(H$,INT(X/16)+1,1);
610 PRINT MID$(H$,1+(XAND15),1);:RETURN
800 SYS 680:C$=CHR$(34)
810 PRINT:PRINT"  TO RELOAD CODE  "
815 PRINT:PRINT"  LOAD"C$"DOWNLOAD",
820 PRINTC$",1,1   (RETURN)"
825 PRINT:PRINT"  THEN TYPE   NEW",
830 PRINT"   (RETURN)"
835 PRINT:PRINT"TO RUN THE PROGRAM",
840 PRINT"   SYS 51000   (RETURN)"
900 PRINT:PRINT:PRINT"1  ENTER DATA"
910 PRINT:PRINT"2  PRINT DATA"
920 PRINT:PRINT"3  SAVE DATA"
930 INPUT Z:ON Z GOTO 100,500,800
```

Figure 2. CBM-64.

```
51000 ? A9068D21D08D20D0=3E2
51008 ? A90F8D8602A90E20=2E4
51016 ? D2FFA9008D15D0A9=4DD
51024 ? FF8D0A02BA8E92CE=510
51032 ? 20CAC920C7CB20F8=4D5
51040 ? CAAD80CEC931F023=532
51048 ? C935F014C936D006=43F
51056 ? 208EC74C5BC7A914=410
51064 ? 20D2FF202FCBD0DB=52E
51072 ? 203FC8A92020D2FF=461
51080 ? 4C93C94C4AC82063=411
51088 ? CC2022CDA95B85FD=4F1
51096 ? A9CE85FE2028CDA0=547
51104 ? 002095CC202FCBC9=404
51112 ? 44F00BC954D0ED20=4E1
51120 ? D2FFA901D007A944=4EF
51128 ? 20D2FFA90885BA20=4B9
51136 ? 25CDA90820ABCCA9=4A3
51144 ? BD85FDA9CD85FEA0=6A0
51152 ? 002095CC2025CD20=383
51160 ? 95CC9848A0048C83=4CC
51168 ? CE20D8C968A82025=4C4
51176 ? CD2095CC9848A906=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6EA
51200 ? 68A82060CBA90185=38A
51208 ? B885B998A293A0CE=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C82025CD=479
51232 ? A9FB20D8FF20F1CB=597
51240 ? 6020D9CCC90DD00B=3FE
51248 ? A90085C7A92020D2=3E0
51256 ? FFA90D20D2FF60A9=4E7
51264 ? 0D2029C8A90D20D2=306
51272 ? FF602063CCA000A9=43F
51280 ? FF9993CEC8D0FA20=5FB
51288 ? D2CB90FB20D2CBB0=5ED
51296 ? FB8D72CEA0008C7C=4D0
51304 ? CE8C7DCE202ECCAD=4D4
51312 ? 72CE29F0C980D0E4=5C6
51320 ? 20D2CBB0DA9973CE=599
51328 ? C8202ECCC009D0F0=4EB
51336 ? A000AD76CE2980D0=492
51344 ? 0FA52B85FB18A52C=3D8
51352 ? 6D75CE85FC4CAAC8=587
51360 ? AD78CE85FBAD79CE=607
51368 ? 85FC20D2CBB0A820=55E
51376 ? D9CC20D2FFC820D9=607
51384 ? CC202ECCC010D0EA=528
51392 ? A92020D2FFAD75CE=56A
51400 ? 202ECD20D2CBB087=4D7
51408 ? CD7CCEF00BA95820=503
51416 ? D2FF2030C84C57C8=52C
51424 ? 20D2CBB0F8CD7DCE=65D
51432 ? D0EBAD75CEA8B993=687
51440 ? CED00E2030C8A991=4EE
51448 ? 20D2FF4C7EC94C57=51F
51456 ? C8A0008C7CCE8C7D=447
51464 ? CE20D2CBB0F091FB=53F
51472 ? 202ECCC8CC77CED0=4D3
51480 ? F020D2CBB0E0CD7C=59E
51488 ? CEF008A95820D2FF=4D8
51496 ? 4C57C820D2CBB0CE=4CE
51504 ? CD7DCEF0034C23C9=473
51512 ? 20ACCB2030C8AD75=409
51520 ? CEA8A9009993CEAD=506
51528 ? 84CEC902D02520BC=436
51536 ? CBA9C820F3CBA955=568
51544 ? 2016CDA95020F3CB=432
51552 ? 20C7CBAC73CEC888=54F
51560 ? B993CED02398D0F7=5D4
51568 ? 4C5BC7A9552016CD=3DF
51576 ? 20F1CB4C63C9AC77=4EF
51584 ? CE20D2CB88D0FA20=57D
51592 ? D2CB20D2CB4C47C9=53E
51600 ? 4C5CC8A52B85FBA5=4F5
51608 ? 2C85FCA000B1FB99=52A
51616 ? 2200C8B1FB8523F0=4CE
51624 ? 0BA52285FBA52385=447
51632 ? FC4C9BC918A5FB69=57D
51640 ? 02852D852F8531A5=37B
51648 ? FC6900852E853085=412
51656 ? 32602063CCA9028D=3E1
51664 ? 84CEA90B8D02DE60=4A3
51672 ? 8E81CE8C82CEA200=533
51680 ? A9098DCDCE202FCB=4D4
51688 ? C914F016C90DF051=4E2
51696 ? C924D01920D2FF8D=544
51704 ? C3CEE84CE5C9E000=64B
51712 ? D0E3E000F0DF20D2=554
51720 ? FFCA4CE5C9C93090=554
51728 ? D4C93A901548ADC3=444
51736 ? CEC924F004684CE5=460
51744 ? C968C94190BFC947=4BA
51752 ? B0BB20D2FF38E930=4D5
51760 ? C90A9002E907E005=36A
51768 ? F0AB9DC3CEE84CE5=61A
51776 ? C9E000F0A0E001D0=52A
51784 ? 07ADC3CEC924F095=4FF
51792 ? A92020D2FFA9FF9D=54F
51800 ? C3CEA2008ECFCE8E=544
51808 ? D0CE8ED1CE8ED2CE=659
51816 ? ADC3CEC924D006A9=512
51824 ? 0F8DCDCEE8BDC3CE=5DD
51832 ? C9FFF01D20CBCAB0=5B2
51840 ? 3418BDC3CE6DCFCE=524
51848 ? 8DCFCEA9006DD0CE=566
51856 ? 8DD0CEB020E84C75=534
51864 ? CAADCFCEAC83CE99=642
51872 ? A3CEC8ADD0CE99A3=660
51880 ? CEC8188C83CEAC82=561
51888 ? CEAE81CE602025CD=4ED
51896 ? A200BD41CEC921F0=500
51904 ? 0720D2FFE84CBACA=570
51912 ? 4CDEC9ADCDCE8DCE=65E
51920 ? CEADCFCE8DD1CEAD=4C1
51928 ? D0CE8DD2CE18ADD1=639
51936 ? CE6DCFCE8DCFCEAD=68F
51944 ? D2CE6DD0CE8DD0CE=6BE
51952 ? B005CECECEDAE660=625
51960 ? 2063CCA90F8D8602=414
51968 ? A95185FDA9CD85FE=575
51976 ? A000209DCC2025CD=343
51984 ? 209DCC209DCC209D=3DF
51992 ? CC2022CD20A9CC20=3A8
52000 ? 95CC2022CD2095CC=411
52008 ? 202FCB20D2FF608E=421
52016 ? 81CE8C82CE2069CC=4B0
52024 ? 20ECCC20CACCC900=40F
52032 ? D00D20FDCCC931F0=4F0
52040 ? 062001CC4C35CB8D=314
52048 ? 80CEAE81CEAC82CE=597
52056 ? 60AE92CE9A4C5BC7=4CE
52064 ? 2022CDA92285FDA9=465
52072 ? CE85FEA0002095CC=4DA
52080 ? 2025CDA00FA92099=393
52088 ? 93CE88D0FA8D93CE=619
52096 ? 202FCBC914D010C0=417
52104 ? 00F0F520D2FF88A9=58F
52112 ? 209993CE4C80CBC9=50A
52120 ? 0DF00B20D2FF9993=4BD
52128 ? CEC8C010D0DAA920=579
52136 ? 20D2FF60A92020D2=4B4
52144 ? FFA94F20D2FFA94B=58C
52152 ? 20D2FF60A9138D00=452
52160 ? DEA9128D00DE60A9=4CD
52168 ? 538D00DEA9528D00=40E
52176 ? DE60A996188D87CE=547
52184 ? 8C82CEAC82CE2004=4D4
52192 ? CC20ECCCCE87CED0=677
52200 ? 02386020FDCCB0EE=509
52208 ? 60A9FA8C82CEA820=597
52216 ? 04CC88D0FAAC82CE=616
52224 ? 602004CC8AA2A8CA=3EE
52232 ? D0FDAA2069CC6020=454
52240 ? 25CDA90220ABCC20=364
52248 ? 95CCAD8ECE20D2FF=573
52256 ? A92020D2FFA90320=3A6
52264 ? ABCC20D8C9604D7D=48A
52272 ? CE8D7DCEA208AD7D=4AA
52280 ? CE2A9010AD7DCE49=411
52288 ? 088D7DCEAD7CCE49=460
52296 ? 108D7CCE2E7CCE2E=3D5
52304 ? 7DCECAD0E160A000=516
52312 ? A9009900D4C8C018=40E
52320 ? D0F660A99320D2FF=5B3
52328 ? 6048A5A2290FD01F=37E
52336 ? A5D448A5A22910F0=4A1
52344 ? 05A9A44C80CCA920=42B
52352 ? 20D2FFA90085D4A9=51C
52360 ? 9D20D2FF6885D468=53F
52368 ? 6020D2FFC8B1FDC9=620
52376 ? 21D0F6C8602025CD=4B9
52384 ? A90C20ABCC2095CC=46D
52392 ? 60A9058E81CEAAA9=4E6
52400 ? 2020D2FFCAD0FAAE=603
52408 ? 81CE60C914F008C9=505
52416 ? 7FF00160A91460A9=456
52424 ? 7F6020E4FFC9C190=5C4
52432 ? 07C9DBB0038E960=4AF
52440 ? 60C941900EC95B90=494
52448 ? 08C9619006C97BB0=49C
52456 ? 0249206048A4800A=2D5
52464 ? 20E1FFD0034C59CB=533
52472 ? 2868AA6860AD00DE=485
52480 ? 49016A9003A90060=250
52488 ? AD01DE6048AD00DE=3C7
52496 ? 49026A6A6860200C=223
52504 ? CDB0FB8D01DE20EC=508
52512 ? CC602025CD2028CD=373
52520 ? A90D20D2FF604829=3A0
52528 ? F06A6A6A6A0930C9=3CA
52536 ? 3A30031869072 0D2=21F
52544 ? FF68290F0930C93A=31B
52552 ? 300318690720D2FF=2F4
52560 ? 60444F574E4C4F41=2C4
52568 ? 44204D454E552131=243
52576 ? 2020205245434549=228
52584 ? 5645213520202045=1FE
52592 ? 58495420544F2042=28A
52600 ? 4153494321362020=22F
52608 ? 2053415645204259=28A
52616 ? 5445532128205553=285
52624 ? 4520122053544F50=26D
52632 ? 209220544F205245=2C4
52640 ? 5455524E20544F20=2CC
52648 ? 4D454E5520292145=28C
52656 ? 4E544552204E554D=2F9
52664 ? 4245522021494620=281
52672 ? 4144445245535320=2E6
52680 ? 495320494E204845=2C8
52688 ? 582C119D9D9D9D9D=476
52696 ? 9D9D9D9D9D9D9D9D=5C0
52704 ? 9D9D9D9D50524546=481
52712 ? 4958205749544820=305
52720 ? 2421535441525420=2E3
52728 ? 4144445245535320=31E
52736 ? 464F522041524541=220
52744 ? 202146494E414C20=1D3
52752 ? 4144445245535320=236
52760 ? 464F522041524541=238
52768 ? 202150524F475241=22C
52776 ? 4D205449544C4520=237
52784 ? 284D415820313620=1E5
52792 ? 4348415227532920=219
52800 ? 21124E4F54205641=21B
52808 ? 4C4944922C205452=2A5
52816 ? 5920414741494E20=249
52824 ? 3A20214449534320=216
52832 ? 4F52205441504520=26B
52840 ? 2820442F54202920=1E0
52848 ? 3F2100000000000=0D0
```



A reminder of how to use the Telsoft service.

download is on line, make sure your modem is set up and dial the number appropriate to its speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received you will see "OK" printed if there are no errors, otherwise the program will wait for the blocks to come round again. When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run.

Option 6 for CBM-64

Note that CBM-64 owners will need to use Option 6 if machine code is to be saved.

Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)";A$
40 A=EVAL("&"+A$)
50 IF A>&6F87 THEN 280
60 IF A<&2A00 OR A>&6FE7 THEN 20
70 PRINT ~A" ";
80 INPUT ":" B$,C$
90 IF LEN(B$) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6F87
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>71 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 :A9CBA0FEA20120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F000C934F0E9C9,4CB
6A18 :35F0064C0C6A4C47,280
6A20 :6AA90C20E3FFA9E8,482
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A20220F4FFA9C8A0,4C0
6A40 :FEA20020F4FF60A9,48C
6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA000,3E8
6A58 :A9FF8099056FD0FA,507
6A60 :A915A20120F4FF20,394
6A68 :0C6C90FB200C6C80,348
6A70 :F8A00084778478B4,416
6A78 :79847A8478857020,388
6A80 :056DA57029F0C980,489
6A88 :D0E2200C6C80D099,468
6A90 :7100C020D56DC009,364
6A98 :D0F0A000A5742980,422
6AA0 :D008A51C857618A5,354
6AA8 :1065730577200C6C,289
6AB0 :B00520E3FFC02005,524
6AB8 :6DC012D0F0A57320,435
6AC0 :B26D200C6C80A0C5,3CC
6AC8 :7AF000A95820E3FF,470
6AD0 :20E7FF4C676A200C,34F
6AD8 :6C800CC57BF000A9,48C
6AE0 :5820E3FF20E7FF4C,4AC
6AE8 :676AA573A8B9056F,43E
6AF0 :D00E20E7FFA90820,388
6AF8 :E3FF4C836B4C676A,469
6B00 :A000847A847B200C,2C9
6B08 :6CB0F2917620D56D,477
6B10 :C8C475D0F1200C6C,45A
6B18 :B0E3C57AF000A958,4CE
6B20 :20E3FF20E7FF4C67,488
6B28 :6A200C6C80CFC578,3C1
6B30 :F000A95820E3FF4C,447
6B38 :676A20C76B20E7FF,429
6B40 :A573A0A90099056F,3F6
6B48 :A58AC902D05020D7,419
6B50 :6BA9C820556CA955,388
6B58 :20306EA95820556C,298
6B60 :A915A20120F4FF20,394
6B68 :F76BA471C000D985,505
6B70 :6FD05198D0F7A90C,4A4
6B78 :20E3FF20A56DA95A,437
6B80 :0582A96F0583A987,3D7
6B88 :20006E20F86D20A8,2D8
6B90 :6DA90520006EA980,2DA
6B98 :20E3FF20F86DA9D2,502
6BA0 :20E0FF4C0C6AA955,38F
6BA8 :20306EA99620556C,2DE
6BB0 :4C6AA8A475200C6C,202
6BB8 :80D0FA200C6C200C,316
6BC0 :6C4C486B4C6C6AA9,336
6BC8 :2020E3FFA96F20E3,43D
6BD0 :FFA96B20E3FF6BA9,51E
6BD8 :9CA000A68AE002D0,41E
6BE0 :0BA21320F4FFA212,387
6BE8 :20F4FF60A29[illegible]20F4,4C0
6BF0 :FFA29620F4FF60A9,553
6BF8 :9CA000A68AE002D0,41E
6C00 :EBA25320F4FFA252,4E7
6C08 :20F4FF6018A99685,44F
6C10 :8F847EA991A20020,38D
6C18 :F4FF8009C007D085,448
6C20 :6B684C0C6AA47E20,2D4
6C28 :496CC60FD0023860,374
6C30 :A58AC90200062079,369
6C38 :6EB0EC60A991A201,447
6C40 :20F4FF98A47EB0DF,55C
6C48 :608AA2D2CAE0CAD0,5AA
6C50 :F8AA60A900847EA8,458
6C58 :20496C80D0FAA47E,449
6C60 :60A9E0A000A2FF20,452
6C68 :F4FFA900050AA90C,460
6C70 :20E3FF20A86DA904,3E4
6C78 :20006EA9090502A9,2F0
6C80 :6F0503A00020F86D,39C
6C88 :20156DC941F000C9,370
6C90 :42F011C943F0174C,3A2
6C98 :616CA900A20120F4,335
6CA0 :FF4CB76CA900A203,3C4
6CA8 :20F4FF4CB76CA900,433
6CB0 :A20420F4FFE60AA5,4CE
6CB8 :7C20E3FFA47E20A0,468
6CC0 :6DA90820006E20F8,2C4
6CC8 :6DA01720156DC941,2D0
6CD0 :F000C942F011C943,413
6CD8 :F0174C616CA907A2,372
6CE0 :0120F4FF4C096DA9,37F
6CE8 :07A20320F4FF4C09,314
6CF0 :6DA907A20420F4FF,3D6
6CF8 :E60AA58AC9[illegible]D009,443
6D00 :A9F0A000A20120F4,3E0
6D08 :FFA57C20E3FF2053,495
6D10 :6C20536C6020A86D,2E3
6D18 :A90520006E20F86D,2C1
6D20 :20A86DA90520006E,274
6D28 :20F86D20A86DA905,368
6D30 :20006E20F86D20A8,2DE
6D38 :6D847EA90320006E,2A9
6D40 :A9D220E0FF857C60,4D8
6D48 :A90C20E3FF20A86D,3EF
6D50 :A90720006EA99A85,306
6D58 :82A96E0583A00020,361
6D60 :F86D20A86D20996D,3C0
6D68 :20996D20996D20A8,317
6D70 :6DA90A20006E20F8,2C6
6D78 :6D20A86DA9072000,270
6D80 :6E20F86D20A86D20,348
6D88 :E7FFA9D220E0FF48,5A8
6D90 :A90FA20020F4FF68,3D5
6D98 :60A90820006E20F8,287
6DA0 :6D20A86D6020A86D,33A
6DA8 :20A86D20E7FF20E7,445
6DB0 :FF604829F06A6A6A,3FE
6DB8 :6A0930C93A300318,1F1
6DC0 :690720E3FF60290F,312
6DC8 :0930C93A30031869,1F0
6DD0 :0720E3FF60457885,3AE
6DD8 :7BA200A57B2A900C,388
6DE0 :A57B4900857BA57A,390
6DE8 :4910857A267A2678,299
6DF0 :CAD0E86020E3FFC8,5AC
6DF8 :B102C90DD0F6C860,4F7
6E00 :B67DAAA92020E3FF,470
6E08 :CAD0FAA67D60C97F,55F
6E10 :D008A98620F4FFE0,4FD
6E18 :00F012A97FC920B0,3C3
6E20 :0EC90AF00AC90DF0,3A1
6E28 :06C907F002A90060,2D1
6E30 :857C867D847EA991,440
6E38 :A20120F4FFA903A2,404
6E40 :0720F4FFA996A200,403
6E48 :20F4FF902902F0F4,48A
6E50 :A47CA997A20920F4,41F
6E58 :FFA903A20420F4FF,464
6E60 :A991A20020F4FFB0,49F
6E68 :09C007D00568684C,2C1
6E70 :0C6AA57CA67DA47E,3DC
6E78 :60847E867DA996A2,446
6E80 :0020F4FF902901F0,3CD
6E88 :0BA996A20920F4FF,408
6E90 :9010900138A67DA4,340
6E98 :7E60444F574E4C4F,281
6EA0 :4144494E47204D45,215
6EA8 :4E550D3120202052,193
6EB0 :4543454956450D34,1F2
6EB8 :2020205345542042,1AE
6EC0 :6175642052617465,2E6
6EC8 :0D35202020455849,188
6ED0 :5420544F20424153,20D
6ED8 :49430D454E544552,217
6EE0 :204E554D4245520D,1F6
6EE8 :2020555345204354,1EC
6EF0 :524C204720544F20,1F5
6EF8 :52455455524E2054,254
6F00 :4F204D454E552029,1ED
6F08 :0D53455420545241,208
6F10 :4E534D4954204261,24E
6F18 :756420526174650D,292
6F20 :4120202037352042,16F
6F28 :6175640D42202033,1FC
6F30 :303020426175640D,209
6F38 :4320313230302042,188
6F40 :6175640D53455420,253
6F48 :5245434549564520,223
6F50 :4261756420526174,2C3
6F58 :650D50524F475241,23D
6F60 :4D20204C4F414445,1F2
6F68 :4420206F6B0D5052,200
6F70 :45535320414E5920,213
6F78 :4B455920464F5220,210
6F80 :4D454E550D202020,1A2
```

Figure 1. Spectrum.

```
5 REM SPECTRUM 48k                fig 1
10 REM Hex Code Loader
15 CLEAR 59000
20 POKE 23658,8: CLS : PRINT
30 INPUT "Start Address ";a
50 IF a>61135 THEN GO TO 280
60 IF a<60000 THEN GO TO 20
70 PRINT a;
80 INPUT " :";b$
85 IF B$="END" THEN GO TO 280
90 IF LEN b$<>20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN PRINT ":";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN LET e=1
320 RETURN
```

Figure 2. Spectrum.

```
60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66EDCD,631
60016 :50EDCD47EE38FBCD,5AF
60024 :8BEDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D0
60040 :15ED3EFACD84EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,58C
60064 :003EFF121310FCCD,458
60072 :15EE11CDEE06173E,3D2
60080 :20121310FCCD1FED,3DA
60088 :30F0CD50EDCD1FED,588
60096 :38FB3265EF3E0032,3E9
60104 :6CEF326FEF3270EF,544
60112 :3A65EFCDE8EC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :091165EFCD1FEDDA,501
60136 :AAEA1312CDE8EC0D,552
60144 :20F23A69EFE60020,51A
60152 :0D21485C3A68EF0E,36C
60160 :004709226BEF0E00,1DA
60168 :11CDEECD1FED389A,47F
60176 :12130CCDE8EC79FE,45C
60184 :1020F03A68EFCD81,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEF8E20133E5811,326
60208 :E0EE12133E0012CD,340
60216 :D7ECCDA6ECC3AAEA,681
60224 :CD1FEDDAAAEA2170,518
60232 :EF8E20E121E5EE3A,524
60240 :68EF856F3E000C67,3CC
60248 :3E008E2000CDD7EC,40F
60256 :3E2132885CC3FFE8,482
60264 :3E00326FEF3270EF,3C7
60272 :ED586BEF0E00CD1F,40C
60280 :EDDAAAEA3273EFCD,634
60288 :E8EC3A68EFFE0020,586
60296 :053A69EFE6003A73,432
60304 :EF12130C3A6AEF89,3FC
60312 :20DCCD1FEDDAAAEA,5D8
60320 :216FEF8EC22DE8CD,584
60328 :1FEDDAAAEA2170EF,5A2
60336 :8EC220E83E6F32E2,589
60344 :EE3E6832E3EE3E00,490
60352 :32E4EE3A885CFE21,581
60360 :2003CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A68,5C5
60376 :EF856F3E000C6736,422
60384 :0021E5EEED4B66EF,561
60392 :0C7EFE00C20DEA23,4FC
60400 :0D20F63EFACD84ED,589
60408 :3E01D3FEC366EACD,5E8
60416 :1FED30FBC38DEAF3,594
60424 :0603AFD3FF10FB3E,308
60432 :40D3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,305
60448 :320D5C32485C3E01,250
60456 :D3FE21915CC89EF8,568
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD0FEC,442
60488 :CD84ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,58F
60504 :CDA0ECCD84ECCDA6,661
60512 :EC233E0DCD0FECCD,4CF
60520 :84EC23CDA3EC3E03,498
60528 :CD0FECCD84ECC9CD,608
60536 :A3EC3E07CD0FECCD,561
60544 :84EC23C97EFE00C8,520
60552 :CD88ED23C384ECFE,651
60560 :00C8F53E20CD88ED,520
60568 :F13DC30FECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CD88ED3EFF320C5C,574
60592 :C9F513E6F0CB1FCB,60C
60600 :1FCB1FCB1FF630FE,4CF
60608 :3AFAC6ECCA071213,498
60616 :F1E60FF630FE3AFA,606
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E20772310FC3E,339
60648 :0077C9E52170EFAE,538
60656 :77C50E087EA7CB17,449
60664 :38007EEE00773A6F,3C9
60672 :EFEE10326FEF3721,305
60680 :6FEFCB1623CB160D,358
60688 :20E2C1E1C9110501,394
60696 :216A00CD8503C93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C0
60720 :ED7BE601F602D3FE,548
60728 :AF2177EF35200237,2FC
60736 :C9CD77ED30E8C9CD,5F0
60744 :47EED0FECBC837C9,5E6
60752 :F5D8FF3A81EFFE00,5C7
60760 :20043E3610023E37,187
60768 :D3FFDB7FF1C9F53A,675
60776 :81EFFE0020043E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00DBFFE60037C8D8,59.
60800 :FFE60237C8D8FFE6,626
60808 :302004D87FA7C93A,3E0
60816 :81EFFE0020043E37,397
60824 :10023E36D3FFD87F,452
60832 :C9CD47ED3A73EFD8,5DE
60840 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9C5D5E5F5FE,78D
60864 :7F2813CDF9EDFE0C,537
60872 :280CF20D20053E20,28A
60880 :D73E0DD710103E20,34F
60888 :D73E08D73A885CFE,4E8
60896 :2120033E08D73E5F,2E6
60904 :D73E08D7F1E1D1C1,640
60912 :C9FE07281CFECB28,4F3
60920 :19FE0C2814FE0828,388
60928 :10FE0D200CFE20FA,367
60936 :0FEEFE00FA11EE3E,4BA
60944 :00C93E07C9CD6800,32C
60952 :3E02CD01163E1832,1C4
60960 :895CC93E121601CD,382
60968 :1122C93E121600CD,257
60976 :1122C9C5D5E53E02,3E8
60984 :CD0116CD47EE38F8,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :385CCB6F200C3A08,28F
61008 :5CF521385CCBAEF1,4C3
61016 :A7C937C9F5111000,3DE
61024 :CD10EDF1C9444F57,4D6
61032 :4E4C4F4144494E47,284
61040 :204D454E550D3120,216
61048 :2020524543454956,276
61056 :450D352020204578,217
61064 :697420746F204261,328
61072 :7369630D20205573,2DF
61080 :652053796D626F6C,393
61088 :2053686966742020,388
61096 :20470D746F205265,2C9
61104 :7475726E20746F20,39C
61112 :4D454E5520290D45,278
61120 :4E544552204E554D,309
61128 :4245522000000000,1C1
```

Cruncher

Terence Simmons presents a spreadsheet program for the Spectrum with many important features including individual cells and windows

Number cruncher is a spreadsheet program for the 48K Spectrum with the following features.

- Labels and formulae may be entered into a matrix of up to 26 rows by 24 columns and referenced to one another, thus enabling scientific, financial, mathematical and other tables or complex models to be generated.
- Individual "Cells" are selected for data input by moving a cursor about the screen. Numbers and formulae may be changed at will on the spreadsheet, which can then be rapidly recalculated; this enables all kinds of "What if" situations to be evaluated.
- The program utilises Paul Rhodes' "Character Print" routine — YC, October 1984 — to give about 50 characters per line and enable a 6 column by 20 row "window" on the matrix, in which the labels, and values relating to formulae entered, are shown.
- All Spectrum maths and logical functions are supported. The contents of cells may be edited similarly to Basic program lines.
- Formulae may be replicated relatively or absoutely. Columns and rows may be inserted or deleted and calculation references in the cells moved are automatically adjusted to maintain the spreadsheet integrity.
- The spreadsheet may be recalculated repeatedly to enable iterative solutions.
- Titles may be set.
- A hard copy of the entire spreadsheet is obtained on a ZX-compatible printer, by printing the columns out sideways.

The program may be entered by first typing out the Basic Listing 1; save this on tape and New the computer. Then enter listing 2 and run it. The program pokes in the hex code, which consists of the sideways character set, print routine and proportional characters, at the addressed prompted.

Save the code with the command.

SAVE "chars" CODE 62900,2380

When the complete program is it will auto-run from line 7900 and present a Menu of available commands which are discussed below. Pressing any key then presents a blank spreadsheet with two axes; the vertical one shows a series of alphabetical characters referring to the Rows, while the numbers on the horizontal axis designate the first six columns.

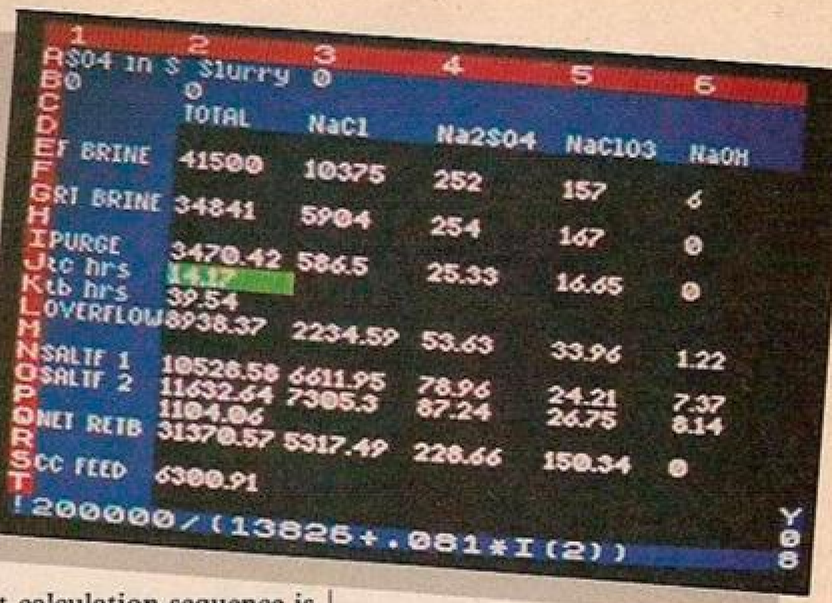
The green cursor in the top left-hand corner relates to cell A (1). The cursor may be moved about the screen to refer to different cells using Caps Shift 5,6,7 and 8.

If you try to go off the screen you will be prompted:- Jump: No. of Columns — or Rows, depending whether you were moving horizontally or vertically. Enter the number of lines along or down the spreadsheet you wish the window to be shifte, the axis range will the change to reflect your response.

To Input into the spreadsheet, press! to enter a value or formula, and "to enter a descriptive Label. The string entered, or its value, will appear in the spreadsheet at the cursor position; the contents of the

Listing 1.

```
  20 GO SUB 5000
  40 LET l=l+(k$=CHR$ 10)-(k$=CH
R$ 11)
  50 LET c=c+5*((k$=CHR$ 9)-(k$=
CHR$ 8))
  53 IF c>26 AND c>=c1 THEN LET
c=26: LET s=1: GO SUB 5000
  54 IF c<1+(tv*5) AND c<=c1 THE
N LET c=1+(tv*5): LET s=-1: GO S
UB 5000
  60 IF l<1+th AND l<=l1 THEN LE
T l=1+th: LET s=-1: GO SUB 5050
  62 IF l>20 AND l>=l1 THEN LET
l=20: LET s=1: GO SUB 5050
  90 PRINT OVER 1; PAPER 0;AT l1
,c1;"     "
  92 LET l1=l: LET c1=c
  93 LET co=INT ((c-1)/5)+u
  94 LET lo=l+v-1
  95 PRINT OVER 1; PAPER 4;AT l,
c;"     "
  96 OVER 0: LET a$=d$(lo,co): P
RINT INK 7; PAPER 1;AT 21,0;a$
  99 IF INKEY$="" THEN PRINT PAP
ER 1;AT 19,31;CHR$ (ll+64);AT 20
,31;INT (cl/10);AT 21,31;cl-10*I
NT (cl/10)
 100 PAUSE 0: LET k$=INKEY$
 110 IF k$>CHR$ 32 THEN BEEP .1,
.1: GO SUB 7000
 115 IF k$=CHR$ 7 THEN GO SUB 20
00
 120 GO TO 30
 300 REM recalc
 310 FOR i=1 TO cl: LET co=i: FO
R j=1 TO ll: LET lo=j: LET l=lo+
1-v
 311 LET a$=d$(lo,co)
 312 IF a$(1)<>"!" THEN GO TO 32
0
 315 GO SUB 4000
 320 NEXT j: NEXT i: LET l=l1: R
ETURN
 350 REM iterate
 355 LET m=1
 360 PRINT AT 21,0;"Iteration ";
m: GO SUB 300
 370 IF INKEY$=" " THEN RETURN
 380 LET m=m+1: GO TO 360
 400 REM insert
 410 INPUT "Insert Row or Column
 (r/c)? ";g$: LET c2=co: LET l2=
lo
 420 IF g$="r" THEN LET tv=0: GO
 TO 500
 430 IF g$="c" THEN LET th=0: FO
R n=1 TO ll: FOR j=cl TO c2 STEP
 -1: LET a$=d$(n,j): IF a$(1)<>"
!" THEN LET s$(n,j+1)=a$(2 TO ):
 GO TO 470
 440 LET k=1
 450 IF a$(k)>CHR$ 64 AND a$(k)<
CHR$ 90 AND a$(k+2)>=STR$ (co) T
HEN LET a$(k+2)=STR$ (VAL a$(k+2
)+1)
 455 IF a$(k)=" " OR k=29 THEN G
O TO 470
 460 LET k=k+1: GO TO 450
 470 LET d$(n,j+1)=a$: NEXT j: L
ET d$(n,j+1)="": LET s$(n,j+1)="
"
 485 NEXT n: LET cl=cl+1: GO SUB
 300: GO SUB 5100: RETURN
 499 REM insert row
 500 FOR n=1 TO cl: FOR j=ll TO
l2 STEP -1: LET a$=d$(j,n): IF a
$(1)<>"!" THEN LET s$(j+(j<26),n
)=a$(2 TO ): GO TO 570
 540 LET k=1
 550 IF a$(k)>=CHR$ (64+lo) AND
a$(k)<CHR$ 90 THEN LET a$(k)=CHR
$ (CODE a$(k)+1)
 560 LET k=k+(k<30): IF a$(k)="
" THEN GO TO 570
 565 GO TO 550
 570 LET d$(j+1,n)=a$: NEXT j: L
ET d$(j+1,n)="": LET s$(j+1,n)="
"
 580 NEXT n: LET ll=ll+(ll<26):
GO SUB 300: GO SUB 5100: RETURN
 705 INPUT "Delete Row or Column
(r/c)? ";g$: IF g$<>"r" AND g$<>
"c" THEN GO TO 705
 720 IF g$="r" THEN LET tv=0: GO
 TO 800
 725 REM del col
 730 LET th=0: FOR n=1 TO ll: FO
R j=co TO cl: LET a$=d$(n,j+(j<2
6)): IF a$(1)<>"!" THEN LET s$(n
,j)=a$(2 TO ): GO TO 770
 740 LET k=1
 750 IF a$(k)>CHR$ 64 AND a$(k)<
CHR$ 90 AND a$(k+2)>=STR$ (co) T
HEN LET a$(k+2)=STR$ (VAL a$(k+2
)-1)
 760 LET k=k+1: IF a$(k)=" " THE
N GO TO 770
 765 GO TO 750
 770 LET d$(n,j)=a$: NEXT j
 785 NEXT n: LET cl=cl-1: GO SUB
 300: GO SUB 5100: RETURN
 800 FOR n=1 TO cl: FOR j=lo TO
ll: LET a$=d$(j+(lo<26),n): IF a
$(1)<>"!" THEN LET s$(j,n)=a$(2
TO ): GO TO 870
 840 LET k=1
 850 IF a$(k)>=CHR$ (64+lo) AND
a$(k)<CHR$ 90 THEN LET a$(k)=CHR
$ (CODE a$(k)-1)
 860 LET k=k+1: IF k=29 OR a$(k)
=" " THEN GO TO 870
 865 GO TO 850
 870 LET d$(j,n)=a$: NEXT j
 880 NEXT n: LET ll=ll-1: GO SUB
 300: GO SUB 5100: RETURN
2000 REM edit
2010 LET a$=d$(lo,co): LET n=1
2015 LET b$=a$(1): IF b$="!" THE
N POKE 23658,8
2020 LET j$=a$( TO n): LET l$=a$
(n+1 TO )
2030 OVER 0: PRINT AT 21,0;j$;"█
";l$
2040 PAUSE 0
2050 LET k$=INKEY$
2053 IF k$=CHR$ 13 THEN LET a$=j
$+l$: PRINT PAPER 1;AT 21,0;a$:
GO TO 7090
2055 IF k$=CHR$ 12 THEN LET j$=j
$( TO n-1): LET n=n-1: LET a$=j$
+l$
2057 IF k$>CHR$ 13 THEN PRINT AT
21,n;k$: LET n=n+1: LET a$=j$+k
$+l$
2058 IF LEN a$>31 THEN LET a$=a$
( TO 31)
2060 LET n=n+((k$=CHR$ 9)-(k$=CH
R$ 8))
2065 IF n>LEN a$ THEN LET n=LEN
a$
2070 GO TO 2020
3990 IF a$(2)="&" THEN LET a$=a$
(2 TO ): LET s$(lo,co)=""
3995 RETURN
4000 GO SUB 3990: LET x=VAL a$(2
 TO ): GO TO 4000+lo
4001 LET A(co)=x: GO TO 4030
4002 LET B(co)=x: GO TO 4030
4003 LET C(co)=x: GO TO 4030
4004 LET D(co)=x: GO TO 4030
4005 LET E(co)=x: GO TO 4030
4006 LET F(co)=x: GO TO 4030
4007 LET G(co)=x: GO TO 4030
4008 LET H(co)=x: GO TO 4030
4009 LET I(co)=x: GO TO 4030
4010 LET J(co)=x: GO TO 4030
4011 LET K(co)=x: GO TO 4030
4012 LET L(co)=x: GO TO 4030
4013 LET M(co)=x: GO TO 4030
4014 LET N(co)=x: GO TO 4030
4015 LET O(co)=x: GO TO 4030
4016 LET P(co)=x: GO TO 4030
4017 LET Q(co)=x: GO TO 4030
4018 LET R(co)=x: GO TO 4030
4019 LET S(co)=x: GO TO 4030
4020 LET T(co)=x: GO TO 4030
4021 LET U(co)=x: GO TO 4030
4022 LET V(co)=x: GO TO 4030
4023 LET W(co)=x: GO TO 4030
4024 LET X(co)=x: GO TO 4030
4025 LET Y(co)=x: GO TO 4030
4026 LET Z(co)=x: GO TO 4030
4030 LET x=INT (f*x)/f: IF a$(1)
<>"&" THEN LET s$(lo,co)=STR$ x:
 IF LEN STR$ x>8 THEN LET x$=STR
$ x: LET y=LEN x$: LET s$(lo,co)
=x$( TO 4)+x$(y-3 TO y)
4035 IF k$<>"i" AND k$<>"d" AND
k$<>"j" THEN LET q=co+1-u: IF q>
=1+tv AND q<=6 AND l<=20 AND l>=
1+th THEN PRINT AT l,(q-1)*5+1;"
    ": PRINT #9;AT l,q*40-32;s$
(lo,co)
4040 RETURN
5000 REM scroll hor
5003 BEEP .1,.1: INPUT "Jump: No
. of Columns ";n
5004 IF n=0 THEN RETURN
5005 LET u=u+(n*s)
5007 IF u>=19 THEN LET u=19
5008 IF u<=1 THEN LET u=1
5010 OVER 0: FOR j=0 TO 5: BRIGH
T 1: PRINT PAPER 2;AT 0,j*5;" ";
j+u;"  ": NEXT j: BRIGHT 0
5015 IF th<>0 THEN PAPER 1: FOR
n=1 TO th: FOR m=tv TO 5: PRINT
AT n,m;"     ": PRINT #9;AT n,((
m+1)*40)-32;s$(n,m+u): NEXT m: N
EXT n: PAPER 0
5030 GO TO 5100
5050 REM scroll vert
5060 BEEP .1,.1: INPUT "Jump: No
. of Rows ";n
5062 IF n=0 THEN RETURN
```



current cell will be reflected in the blue band at the bottom of the window. For example, suppose cell A (1) contains the value 12 and we want to calculate 25 per cent of this and put the result in A(2). Move the cursor across one column and enter A(1)*.25

The value 4 will appear in the spreadsheet at the cursor position, whole the formula is printed in the Cell Contents line.

A formula in a particular cell can be up to 29 characters long; longer expression may be handled by splitting them up. The value or label will be displayed in the spreadsheet up to eight or nine characters long, scientific notation being used to display greater values.

The contents of the Current Cell may be edited by pressing Caps Shift 1. The relevent string will then appear at the bottom of the screen and may be altered using the left-right cursor and Delete keys. Note that Extended Mode functions such as Sin may not be edited in this way, the string may have to re-entered.

Commands are accessed by pressing the (/) symbol (S Shift V) — instead of the (!) or (") keys — followed by the character specific to the function required.

ε — RECALCULATE — Recalculates the Spreadsheet row by row. This is used when a value or formula is altered.

$ — DECIMAL FORMAT — Specifies the number of decimal places displayed. Defaults to two.

a — REPEATED RECALCULATION — This allows problems requiring iterative calculations to be solved. The number of the current calculation sequence is printed at the bottom of the screen. The iterative process is halted by pressing the Space bar when the problem has converged to the required degree of accuracy (keep the bar pressed until the current calculation sequence is complete). As an example of the use of this command. The speadsheet above (fig. 1) has to be interated by adjusting the value of I(2) until the two values in N(2) and O(2) were identical within acceptable limits. This was achieved by adding the difference between N(2) and O(2) to I(2) with each loop, i.e. the formula in I(2) was set at I(2) + −0(2)7. The iteration procedure was halted manually when the difference printed in P(2)) was less than 1.

b — BLANK CELL — Clears the current Cell.

c — CONCEAL CELL — Clears the cell on the Spreadsheet but retains the formula/

(continued on next page)

```
5065 LET v=v+(n*s)
5070 IF v>=7 THEN LET v=7
5075 IF v<=1 THEN LET v=1
5080 BRIGHT 1: FOR g=1 TO 20: PR
INT PAPER 2; OVER 0;AT g,0;CHR$
(g+v+63): NEXT g: BRIGHT 0
5090 IF tv<>0 THEN PAPER 1: OVER
 0: FOR n=1 TO 20: FOR m=0 TO tv
-1: PRINT AT n,(m*5)+1;"     ";
PRINT #9;AT n,((m+1)*40)-32;s$(n
+v-1,m+1): NEXT m: NEXT n: PAPER
 0
5100 REM print screen
5105 LET x=19-th: LET y=u+5-tv
5110 OVER 0: FOR i=u TO (cl<=y)*
cl+(cl>y)*y: LET co=i+tv
5120 FOR l=0 TO (ll<=x)*ll+(ll>x
)*x
5125 PRINT AT l+1+th,((co-u)*5)+
1;"     "
5130 PRINT #9;AT l+1+th,((co+1-u
)*40)-32;s$(l+v+th,co)
5140 NEXT l: NEXT i
5150 LET l=l1: RETURN
6000 REM replicate
6010 LET z$="": INPUT "Replicate
 Hor or Vert ?";g$
6012 IF a$(1)="!" THEN INPUT "Ab
solute or Relative (A/R)? ";z$
6015 INPUT "Range (<26/24)? ";n
6018 LET b$=a$(1): LET c$=a$(2 T
O )
6020 IF g$="v" THEN GO TO 6100
6040 REM repl hor
6045 LET d=co: FOR j=d+1 TO d+n:
 LET co=j
6050 IF a$(1)=CHR$ 34 OR z$="a"
THEN LET s$(lo,co)=c$: LET e$=c$
: GO TO 6080
6060 IF b$="!" THEN LET e$=c$: F
OR k=1 TO LEN c$
6065 IF c$(k)>CHR$ 64 AND c$(k)<
CHR$ 90 THEN LET e$(k+2)=STR$ (V
AL c$(k+2)+j-d)
6070 NEXT k: LET a$=b$+e$: GO SU
B 4000
6080 LET d$(lo,co)=b$+e$: NEXT j
: IF co>cl THEN LET cl=co
6085 IF a$(1)=CHR$ 34 THEN GO SU
B 5100
6090 RETURN
6100 REM repl vert
6110 LET d=lo: FOR j=d+1 TO d+n:
 LET l=j: LET lo=j
6120 IF a$(1)=CHR$ 34 OR z$="a"
THEN LET s$(l,co)=c$: LET e$=c$:
 GO TO 6160
6130 IF b$="!" THEN LET e$=c$: F
OR k=1 TO LEN c$
6140 IF c$(k)>CHR$ 64 AND c$(k)<
CHR$ 90 THEN LET e$(k)=CHR$ (COD
E c$(k)+j-d)
6150 NEXT k: LET a$=b$+e$: GO SU
B 4000
6160 LET d$(l,co)=b$+e$: NEXT j:
 IF lo>ll THEN LET ll=lo
6165 IF a$(1)=CHR$ 34 THEN GO SU
B 5100
6170 RETURN
6820 REM print
6821 LET chars=62644: POKE 23606
,180: POKE 23607,244
6822 FOR c=1 TO cl: FOR w=1 TO 8
: LET m=0: FOR j=ll TO 1 STEP -1
6825 LPRINT s$(j,c,w);: LET m=m+
1
6830 FOR i=1 TO (ll<9)+(ll<12)+(
ll<17): LPRINT " ";: LET m=m+1:
NEXT i
6837 NEXT j: FOR i=1 TO 32-m: LP
RINT " ";: NEXT i
6840 NEXT w: FOR b=1 TO 32: LPRI
NT " ";: NEXT b: NEXT c: POKE 23
606,0: POKE 23607,60: RETURN
6910 REM load
6920 FOR j=1 TO ll: FOR k=1 TO c
l: LET a$=d$(j,k): IF a$(1)=CHR$
 34 THEN LET s$(j,k)=a$(2 TO )
6930 IF a$(1)="!" THEN LET lo=j:
 LET co=k: GO SUB 4000
6940 NEXT k: NEXT j: CLS : GO SU
B 8010: GO SUB 5100: RETURN
7000 OVER 0: IF k$="/" THEN PRIN
T PAPER 1;AT 21,0;"COMMAND: @$AB
CDIJMPRSTX": GO SUB 7300: BEEP .
1,.1: GO TO 30
7010 IF k$<>"!" AND k$<>CHR$ 34
THEN RETURN
7030 IF lo>ll THEN LET ll=lo
7040 IF co>cl THEN LET cl=co
7050 IF k$="!" THEN PRINT PAPER
1;AT 21,0;"Value ": POKE 23658,8
7055 IF k$=CHR$ 34 THEN PRINT PA
PER 1;AT 21,0;"Label "
7060 DIM a$(29): INPUT LINE a$
7070 IF k$="!" THEN POKE 23658,0
7080 PRINT PAPER 1;AT 21,1;a$: L
ET a$=k$+a$
7090 IF a$(1)=CHR$ 34 THEN LET s
$(lo,co)=a$(2 TO ): PRINT #9;AT
l,((co+1-u)*40)-32;s$(lo,co)
7100 IF a$(1)="!" THEN GO SUB 40
00
7110 LET d$(lo,co)=a$
7120 LET k$="": OVER 1: RETURN
7300 POKE 23658,0: PAUSE 0: LET
k$=INKEY$: PRINT AT 21,1;k$
7302 IF k$="@" THEN GO SUB 300:
RETURN
7325 IF k$="b" THEN LET d$(lo,co
)="": PRINT AT l,c;"     ": LET
s$(lo,co)="": IF a$="!" THEN GO
SUB 4000: RETURN
7330 IF k$="t" THEN LET tv=co-1:
 LET th=lo-1: FOR n=1 TO th: PRI
NT OVER 1; PAPER 1;AT n,1;"
                             ": NEXT
 n: FOR n=1 TO 20: FOR m=0 TO tv
-1: PRINT OVER 1; PAPER 1;AT n,(
m*5)+1;"     ": NEXT m: NEXT n:
RETURN
7340 IF k$=" " THEN LET th=0: LE
T tv=0: LET q=0
7345 IF k$="a" THEN GO SUB 350
7350 IF k$="r" THEN GO SUB 6000
7360 IF k$="i" THEN GO SUB 400
7365 IF k$="d" THEN GO SUB 700
7370 IF k$="$" THEN INPUT "No. o
f Decimal Places? ";p: LET f=10↑
p
7376 IF k$="x" THEN INPUT "Clear
-Enter y to Confirm "; LINE z$:
IF z$="y" THEN GO TO 7910
7377 IF k$="m" THEN CLS : GO TO
20
7380 IF k$="c" THEN LET s$(lo,co
)="": PRINT AT l,c;"     ": LET
a$=d$(lo,co): LET a$(2 TO )="&"+
a$(2 TO ): LET d$(lo,co)=a$(1)+a
$(2 TO )
7385 IF k$="j" THEN INPUT "Sprea
dsheet Depth(<=26)? ";ll: INPUT
"Spreadsheet Width(<=24)? ";cl:
LOAD "" DATA d$(): GO SUB 6910
7386 IF k$="s" THEN GO SUB 9002
7395 IF k$="p" THEN GO SUB 6820
7400 RETURN
7899 REM Start
7900 BORDER 0: PAPER 0: OVER 0:
INK 7: CLEAR 62899: LOAD ""CODE
: CLS
7910 RANDOMIZE USR 63744: GO SUB
 8004
7920 LET f=100: LET q=0: LET th=
0: LET tv=0: LET u=1: LET v=1: L
ET ll=1: LET cl=1: LET l1=1: LET
 c1=1: LET l =1: LET c=1: LET k$
="": GO TO 20
8000 POKE 23606,0: POKE 23607,60
: REM menu
8001 PRINT "ENTER LABEL......"""
'"ENTER FORMULA....!"'"REFER TO
CELL...x(n)"'"COMMANDS:"'"/T....
........SET TITLES"'"/B.........
...BLANK CELL"'"/C...........CONC
EAL CELL"'"/R........REPLICATE C
ELL"'"/I.........INSERT ROW/COL"'
"/D.........DELETE ROW/COL"'"/@..
.........RECALCULATE"'"/A.......
.........ITERATE"'"/$.........DECI
MAL FORMAT"'"/X.....CLEAR SPREAD
SHEET"'"/M.....................MENU
"'"/J..............LOAD DATA"'"/S
...............SAVE DATA"'"/P.....
PRINT SPREADSHEET"
8003 PRINT AT 21,2: INK 2: PAPER
 6;"PRESS ANY KEY TO CONTINUE":
PAUSE 0: CLS : GO SUB 5010: GO S
UB 5080: RETURN
8004 CLS : LET co=24: LET lo=26:
 LET w=31
8005 DIM A(co): DIM I(co): DIM B
(co): DIM C(co): DIM D(co): DIM
D(co): DIM E(co): DIM F(co): DIM
 G(co): DIM H(co): DIM J(co): DI
M K(co): DIM L(co): DIM M(co): D
IM N(co): DIM O(co): DIM P(co):
DIM Q(co): DIM R(co): DIM S(co):
 DIM T(co): DIM U(co): DIM V(co)
: DIM W(co): DIM X(co): DIM Y(co
): DIM Z(co): DIM s$(lo,co,8): D
IM d$(lo,co,w)
8006 RETURN
8010 BRIGHT 1: FOR g=1 TO 21: PR
INT PAPER 2;AT g,0;CHR$ (g+64):
NEXT g: FOR j=0 TO 5: PRINT PAPE
R 2;AT 0,j*5;" ";j+1;"   ": NEX
T j: BRIGHT 0
8020 RETURN
9000 SAVE "multicalc" LINE 7900:
 SAVE "chars"CODE 62900,2380
9001 VERIFY "multicalc": VERIFY
"chars"CODE 62900,2380
9002 INPUT "Filename ?";g$: SAVE
 g$ DATA d$()
9003 VERIFY g$ DATA d$()
```



THE 520ST. OVER QUAL

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Screens.



THE ATARI 520ST Personal Computer has a list of qualifications as long as your arm. With a powerful 16 bit processor and 512k of memory linked to high resolution graphics and 512 colours its work is fast, clear and sharp on your screen, no matter how demanding the task.

Controlling the 520ST is easy through its mouse and unique operating system incorporating GEM desk top manager, whilst its eleven peripheral connectors including MIDI interface enables it to mix and communicate easily with other computer products.

The ST which presents itself in smart modern styling comes with powerful BASIC plus Logo programming languages, a word processor and drawing programme, yet costs only £652* including disc drive and black and white monitor.

Why? Because at Atari we bring up our products to work hard for their living.

IFIED AND UNDERPAID.

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Cruncher

(continued from page 75)

value in memory. This is useful for storing intermediate steps in calculations.

d — DELETE — Deletes the Row or Column in which the Cursor rests. When called the routine prompts "Delete Row or Column?" — respond with an r or c. The line will then be deleted and the following rows or columns will be closed up to fill the gaps. Formulae moved in this way are altered relatively so that their values are unchanged.

The amount of string-searching and altering required by this routine is such that several minutes may be required for its completion, depending on the Spreadsheet size, so be patient!

i — INSERT — opposite of DELETE; following rows or columns are spaced out to leave room for the blank line inserted — formulae moved are altered relatively to leave their values unchanged. Like Delete, this routine can take a few minutes to complete.

j — LOAD — Loads a Data file into the Spreadsheet. The program asks for the number of rows and columns in the array to shorten the time required to calculate the Spreadsheet once the data has loaded.

m — MENU — Calls up the Help Screen of Commands. This can also be useful for returning the Spreadsheet screen to normal if display problems have occured; i.e. as happens sometimes when Extended Mode functions are used in a formula.

Figure 1.

SO4 in S	Slurry	0				
	TOTAL	NaCl	Na2SO4	NaClO3	NaOH	H2O
F BRINE	41500	10575	252	157	6	30703
RT BRINE	34841	5904	254	167	0	28516
PURGE	5128.75	866.75	37.43	24.61	0	4199.95
tC hrs	14.04					14.04
tB hrs	37.46					37.46
OVERFLOW	8781.83	2195.45	52.69	33.37	1.2	6499.11 0
SALTF 1	12017.45	7546.96	90.15	27.64	8.41	4344.3
SALTF 2	12018.01 0.55	7547.31	90.15	27.64	8.41	4344.51 0.55
NET RETB	29712.24	5037.24	216.56	142.38	0	24316.06 0
CC FEED	8541.04					8541.04 0
CYC FEED	32206.77	13075.95	115.94	74.07	22.54	18918.25 0
CYC OFL	20188.76	5528.65	25.6	46.43	14.13	14573.74 0

p — PRINT — Prints out the full Spreadsheet sideways on a ZX-compatible printer (see Fig 1).

r — REPLICATE — Reproduces the contents of the Current Cell along a Row or down a Column. The program will prompt: "Replicate Hor or Vert?" to which you should respond with "h" to copy along a Row or "v" to copy down a Column. If the Cell to be copied contains a formula with references to other cells, you will then be asked "Absolute or Relative?" If the response "a" is given, the formula will be repeated exactly; otherwise by replying "r" the equation will be changed relatively each time it is repeated — e.g. A(1) in a formula replicated downwards would become B(1), C(1), etc., while horizontal replication would result in A(2), A(3) and so on.

Finally you will be prompted "Range ?" which is asking the number of Rows or Columns to be reproduced. The bottom right-hand corner of the screen displays the coordinate number of the bottom right hand of the Spreadsheet — this changes when the Sheet gets larger following the use of Replicate or Insert.

s — SAVE — Saves the contents of the Spreadsheet on tape as a data array under a filename as specified by the user.

t — TITLES — Sets the areas of the screen above and to the left of the Cursor as horizontal and/or vertical descriptive Titles. This area becomes highlighted by a blue background and cannot be changed using the Cursor. The Titles remain onscreen as you Jump from window to window. To cancel Titles press "/" and the Space Bar. (Titles which would be corrupted by Insert or Delete are automatically cancelled when these Commands are used).

x — CLEAR SPREADSHEET — Clears the screen and arrays and sets the Cursor at A(1). The user is asked for Confirmation first.

Those who wish to add their own commands or functions will find this information useful. The Spreadsheet data is held in two arrays; d$(1o,co,31) holds all the formulae, labels and uncalculated values, while s$(1o,co,8) holds the screen display. Variables A(1 to 24) . . . Z(1 to 24) are set up to hold the value of each Cell.

Lines

40-120 Cursor movement loop.
300-320 Recalculation subroutine.
350—380 Iteration loop
400-580 Insert routines.
705-880 Delete routines.
2000-3995 Edit routine.
400-4040 Calculation routine
5000-5095 Window Jump routines.
5100-5150 Print Screen.
6000-6060 Replicate routines.
6820-6840 LPrint routine.
6910-6940 Data load routine.
7000-7120 Input routine.
7300-7400 Command select.
7900-8020 Initialise/Menu.

Important variables are:

c,1 Cursor position on screen (hor,vert)
co,lo Cell position in Spreadsheet
cl,ll Current size of Spreadsheet
th,tv Title widths (hor, vert)
u,v Number of current window (hor,vert)

If the program terminates with an error message or if you Break, restart using Goto 20.●

Listing 2.

```
  1 REM crunch 1084
  2 DEF FN a(a$)=CODE a$-48-7*(a$>"9")-32*(a$>"Z"): DEF FN h(a$)=FN a(a$(1))*16+FN a(a$(2))
 10 RESTORE : LET s=62900: FOR x=100 TO 390 STEP 10
 20 READ a$: LET t=VAL a$( TO 5): LET a$=a$(6 TO ): IF LEN a$/2<>INT (LEN a$/2) THEN PRINT AT 16,0;"Length error in line ";x: STOP
 40 POKE s,FN h(a$): LET t=t-PEEK s: LET s=s+1
 50 LET a$=a$(3 TO ): IF a$<>"" THEN GO TO 40
 60 IF t THEN PRINT AT 16,0;"Error in line ";x: STOP
 70 PRINT AT 16,0;"Line ";x;" OK"
 80 NEXT x
100 DATA "[illegible]"
110 DATA "[illegible]"
120 DATA "[illegible]"
130 DATA "[illegible]"
140 DATA "[illegible]"
150 DATA "[illegible]"
160 DATA "[illegible]"
170 DATA "[illegible]"
180 DATA "[illegible]"
190 DATA "[illegible]"
200 DATA "[illegible]"
210 DATA "[illegible]"
220 DATA "[illegible]"
230 DATA "[illegible]"
240 DATA "[illegible]"
250 DATA "[illegible]"
260 DATA "[illegible]"
270 DATA "[illegible]"
280 DATA "[illegible]"
290 DATA "[illegible]"
300 DATA "[illegible]"
310 DATA "[illegible]"
320 DATA "[illegible]"
330 DATA "[illegible]"
340 DATA "[illegible]"
350 DATA "[illegible]"
360 DATA "[illegible]"
370 DATA "[illegible]"
380 DATA "[illegible]"
390 DATA "[illegible]"
```



ATARI ST

520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizeable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below: 1) TOS -Tramiel Operating System based on CPM 68K. 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment. 3) DR GEM Paint for creating graphics masterpieces. 4) DR GEM Write for word processing. 5) Logo learning language to enable you to write your own programs easily using turtle graphics. 6) DR Personal Basic a powerful user friendly version of the Basic programming language. 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3½ inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to do battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:

- ★ ***512K RAM***
- ★ ***MOUSE***
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- ★ ***B/W MONITOR***
- ★ ***500K 3.5" DISK DRIVE***
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£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
16K ROM expendable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

GRAPHICS
Individually addressable 32K bit-mapped screen with 3 screen graphics modes:
320x200 pixels in 16 colours (low resolution)
640x200 pixels in 4 colours (med resolution)
640x400 pixels in monochrome (high res)
16 shades of grey in low res mode
512 colours available in low/medium res
8 levels of each in red, green and blue

ARCHITECTURE
4 custom designed chips:
GLUE Chip - MMU Memory Mngmnt Unit
DMA Controller - Graphics Processing Unit
16/32 bit Motorola 68000 processor at 8MHz
eight 32 bit data registers
eight 32 bit address registers
16 bit data bus/24 bit address bus
7 levels of interrupts/56 instructions
14 addressing modes/5 data types

DATA STORAGE
High speed hard disk interface
Direct memory access 1.33 Mbytes per second
CD (Compact Disc) interface
Built in cartridge access
Dedicated floppy disk controller

DISK DRIVE
500K (unformatted) s/sided 3½" floppy d/drive
349K (formatted) storage capacity

SOUND AND MUSIC
Sound Generator
Frequency control from 30Hz to above audible
3 voices (channels) in wave shaping sound in addition to a noise generator
Separate frequency and volume controls
Dynamic envelope controls
ADSR (Attack, Decay, Sustain, Release)
Noise generator
MIDI interface for external music synthesizers

KEYBOARD
Separate keyboard microprocessor
Standard QWERTY typewriter styling
Ergonomic angle and height
95 keys including 10 function keys
Numeric keypad — 18 keys including ENTER
One touch cursor control keypad

MONITOR
12" screen - high res monochrome monitor
640x400 monochrome resolution

VIDEO PORTS
Display - Low Resolution - 40 columns
Med/High Res - 40/80 plus cols
Medium res RGB (Red/Green/Blue) output
High resolution monochrome (Black & White)

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 2 button mouse)
MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
WIMP - Window Icon Mouse Pop-down menus
Two button mouse controller
Icons/Pull down menus/Windows
GEM VDI - Virtual Device Interface
GEM AES - Application Environment Services
GEM BBT - Bit Block Transfer
Real time clock & calendar

SOFTWARE
GEM environment with user friendly Macintosh style operation
'TOS' - Tramiel Operating System
Atari's own system based on CP/M 68K, with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
'BOS' - Business Operating System
to run any standard BOS business programs
GEM desktop
with GEM PAINT graphics mgmt system and GEM WRITE word processor
Personal BASIC and DR Logo
originally written by Digital Research (DR). Very much like those on other machines except for the extensive use of pull down menus, mouse control and windows

VARIOUS
Dimensions: 470mmx240mmx60mm
Replaceable external power supplies
Expansion: 3½" floppy disk drives 500K/1,000K (two drives can be connected)
3½" 15Mb hard disk
CD (compact laser disc)
Dot matrix & d/wheel prntrs (black)
Thermal dot matrix (colour)
RGB & monochrome monitors

LANGUAGES
BASIC & LOGO supplied
Many others will soon be available, including Assembler, BCPL, C, Cobol, Compiled Basic, Lisp, Modular-2 and Pascal

Note: Some of the above specifications are pre-release and may therefore be subject to change

MACINTOSH v F1e v 520ST

"Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price."
June 1985 - Jack Schofield - **PRACTICAL COMPUTING**

FEATURES OF BASIC SYSTEM	APPLE MACINTOSH	APRICOT F1e	ATARI 520ST
Price Includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5¾x2	17½x6½x1	18½x9½x2½
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (18 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

	APPLE MACINTOSH	APRICOT F1e	ATARI 520ST
Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	£2,984	£1,362	£749

PRESS COMMENT

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is war'."
August 21st 1984 **FINANCIAL TIMES**

"This is the only personal computer I know of that comes with a Midi interface as standard."
Peter Bright March 1985 **PERSONAL COMPUTER WORLD**

"The (GEM) version running on the Atari 68000 machines will have the additional advantage of leaving the PC version standing." April 6th 1985 **PERSONAL COMPUTER NEWS**

"It would seem that GEM offers the ideal operating system."
March 7th 1985 **POPULAR COMPUTING WEEKLY**

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
Peter Bright Feb 1985 **PERSONAL COMPUTER WORLD**

"The electronics in the machine are a work of art ... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip ... when the machine appears in the shops, I'll be at the front end of the queue to buy one."
Peter Bright June 1985 **PERSONAL COMPUTER WORLD**

"This machine is significantly more powerful than an IBM PC ... if it's possible to design a sure-fire winning machine, this is it."
May 11th 1985 **PERSONAL COMPUTER NEWS**

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour), that they are already being called 'Jackintoshes'."
May 2nd 1985 **COMPUTING**

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying — easy-to-use computing power without the price." March 1985 **ANALOG COMPUTING**

"It (the ST) uses the most modern technology that is affordable, in a package that gives a professional impression."
May 23rd 1985 **POPULAR COMPUTING WEEKLY**

"The Atari ST is one of the most elegant designs I have seen ... Atari has used an original and elegant method of memory management which should make the ST faster than any other PC on the market - in any price bracket ... The 64K dollar question is would I go out and spend money for one? To which the only answer is 'Try and stop me!'"
John Lambert July 1985 **ELECTRONICS & COMPUTING**

"The 520ST is technically excellent ... The 520ST hardware is the new standard by which others will be judged."
July 1985 **YOUR COMPUTER**

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PLEASE SEND ME FREE LITERATURE

ON THE NEW ATARI 520ST COMPUTER

Mr/Mrs/Ms: .... Initials: .... Surname: ....

Address: ....

Postcode: ....

Do you already own a computer
If so, which one do you own?

Snowbot

Keith Suddick and his evil robots — with a Christmas game for the CBM-64.

George is the park-keeper at the local park and as it was getting near Christmas he decided to put the park's Chrismas tree up. He spent all day decorating it and the last thing he did was to hang lights on it.

During the night however a strange electrical storm caused havoc in the town, but worse than that it caused all the snowmen that the children had built in the park to turn into evil robots — Snowbots.

The Snowbots needed energy to keep them going and the first thing they found was George's Christmas tree so they stole all the lights from it. When George found out about this he realised he had to try and get the lights back and destroy the Snowbots.

After thinking for a while he remembered that he had some flares left over from the fireworks display. He soon discovered that not only did the Snowbots not like the flares, the heat actually melted them and gave George an opportunity to get the lights back.

He also found out he had to be doubly careful because Snowbots can make huge icicles come crashing down from the trees. Armed with a supply of flares he set off into the park to confront the Snowbots...

Needless to say, George isn't that bright and he needs a bit of help — a joystick plugged into port 2 will let you control George's movement, the fire button will make him throw a flare — use the spacebar to pause.

Each Snowbot you manage to dispatch earns you 10 points, each icicle is worth 20 points and there is a bonus of 50 points for each light bulb you recover. The light bulbs are hidden inside some of the Snowbots and they will automatically be displayed with any others you have. There are eight light bulbs in a set and each screen ends when you have a complete set. The bottom line of the screen shows the set of lights and any bulbs you have will light up. The small flag on the bottom line indicates the level of play you are currently at. The top of the screen shows the usual — score, lives left and the highest of the recorded high scores. The game will record five entries of names and high scores and they are displayed during the title sequence.

Typing the program brings the usual problem of Commodore control characters. I have tried to make things easier by including Remark statements after most of the difficult lines. Unfortunately some of the lines are too long to be treated this way but none of these lines contain anything very complicated so they should not prove too much of a problem.

There is a considerable amount of data to be dealt with — definitions of sprites and the machine-code routines used to move the sprites, smooth scroll the screen etc. For the two large sections of data I have included a checksum which should show if there are any data errors. Part 1 of the data is lines 15000-15999 and part 2 is lines 16000-16999 in case it finds an error. It takes quite a while to read the data in but this is only done once when the program is first run. If the data is correct then even stopping the program and re-running it will not re-read the data.

One very important point, the program uses a rather unconventional method of getting the game started and for this to work line 0 must be typed exactly as shown, no extra space or anything even though it may look wrong. If you are typing the program in don't forget to save a copy before you run it. I do not recommend attempting to save a copy after running it — whether it works or not. The program interferes with the normal interrupt routines and interrupt sources, so unpredictable things may happen during saving. If you would rather not type the listing then I can supply tape copies for £2.00. Please write to Keith Suddick 6 Ravel Court, Jarrow, Tyne & Wear, NE32 3BW.

Table 1.

cd	cursor down	ron	ctrl+9	pur	ctrl+5	gr2	C=+5
cu	cursor up	rof	ctrl+0	grn	ctrl+6	lgr	C=+6
cl	cursor left	hm	home	blu	ctrl+7	lbu	C=+7
cr	cursor right	clr	shift+home	yel	ctrl+8	gr3	C=+8
sp	space	ins	shift+del	s/ shift + following character			
blk	ctrl+1	ora	C=+1	c/ ctrl + following character			
wht	ctrl+2	brn	C=+2	=/ Commodore key + following character			
red	ctrl+3	lrd	C=+3				
cyn	ctrl+4	grl	C=+4	Leading numbers indicate repetitions			

```
0 PRINT"":POKE56,128:RUN9000:GOTO10:GOTO7000
1 PRINT""TAB(RND(U)*T)".."TAB(RND(U)*T1+T)". ":POKEL1,UL:RETURN
10 POKESS,0:S=0:M=3:L=0:EL=1:POKE2,0:POKEFX,199
100 FORX=0TO7:POKESM+X,.:NEXT:GOSUB900:POKEIS,U
110 SN=(SM+U)AND3:RN=SN*2:IFPEEK(SM+RN)=.THENGOSUB200
120 IFPEEK(KB)=60THENGOSUB1000
130 H=PEEK(2):H3=HAND3:ONH3+UGOTO150,300,500
140 POKE2,.:GOTO110
150 IFPEEK(IC)THEN110
160 IFRND(U)<((32-L/4)*IQ)THEN110
170 X=INT(RND(U)*2):POKEID,X:POKEIY,64
180 POKEIX,128-127*(X=.)-97*RND(U):POKEIC,94:GOTO110
200 POKESP+2+SN,6:IFRND(U)>.7THENRETURN
210 POKEV0+4+RN,RND(U)*16:POKEV1+4+RN,RND(U)*80+128
220 IFL>15THENLY=7:LX=3:GOTO240
230 LY=L/2:LX=L/8
240 POKESM+RN,XS(RND(U)*2,LX)OR128*INT(RND(U)*2)
250 POKESM+U+RN,YS(RND(U)*3,LY):RETURN
300 POKEIS,.:POKEV0+22,199:POKESP,13
310 POKEG3,128:POKEF3,8:POKEG3,129
320 FORY=PEEK(V1)TO0STEP-1:POKEV1,Y
330 POKEG1,16:POKEF1,Y/6:POKEG1,17
340 FORX=1TO10:NEXT:NEXT
350 M=M-U:IFM<UTHEN800
390 GOTO100
400 POKEF1,20:POKEG1,65:POKESP+6,14:POKEIC,U:PT=20:GOSUB600
410 POKEIX,.:POKESP+6,12:POKE2,.:GOTO110
500 POKEG1,64:POKEFC,U:HS=FNB(H)-2:IFHS>3THEN400
510 POKEF1,10:POKEG1,65:RN=HS*2:POKESM+RN,.:POKESP+2+HS,14
520 PT=10:GOSUB600:LD=LD-U:IFLDTHEN590
530 POKELP+2*LT,81:LD=INT(RND(U)*L/2+2)
560 PT=50:GOSUB600:LT=LT+U:IFLT=8THEN700
570 POKEF2,80:FORX=1TO5:POKEG2,16:POKEG2,17
580 FORY=1TO50:NEXT:NEXT
590 POKEV1+4+RN,.:POKE2,.:GOTO110
600 S=S+PT:PRINT""S
610 IFS>H(0)THENPRINT""TAB(20)S
620 IFELTHENIFS>1000THENM=M+1:EL=.:GOSUB3000:PRINT""TAB(34)M
630 RETURN
700 PRINT"":POKEV1,160:POKESS,U:POKEIS,.:POKESP,8:POKEV0+22,199:L=L+1
710 PRINT""SS$:FORX=1TO25:GOSUB1:NEXT
720 PRINT"":FORX=1TO39:PRINTPR$;:NEXT
730 PRINTP1$X$""TAB(27)T1$P1$LS(1)
740 PRINTTAB(23)"""SPC(27)"| LEVEL "L;TAB(35)"|"
750 PRINTTAB(23)"|"SPC(11)"|"SPC(27)"| COMPLETED |"SPC(27)""
760 FORX=0TO20:PRINTP1$LS(XAND1):POKEF1,(X+5)*5:POKEG1,64:POKEG1,65
765 FORY=0TO80:NEXT:NEXT:POKESS,.
770 FORX=1TO15:GOSUB1:NEXT:PRINT""SPC(8)""
780 PRINTTAB(8)"| NOW TRY LEVEL "L+1TAB(28)"|"
790 PRINTTAB(8)"":FORX=1TO9:GOSUB1:POKEF1,(10-X)*5
799 POKEG1,64:POKEG1,65:NEXT:FORX=1TO800:NEXT:GOTO100
800 POKESS,.:POKECL,10:PRINT
810 PRINTTAB(8)""
820 PRINTTAB(8)"| G A M E   O V E R |"
830 PRINTTAB(8)""
840 FORX=1TO2000:NEXT:PRINT""SS$
850 FORX=1TO25:GOSUB1:NEXT:HP=-1
860 FORX=4TO0STEP-1:IFS=>H(X)THENHP=X
870 NEXT:IFHP<0THEN8000
880 GOTO2000
900 POKE251,199:POKESS,0:SYS36892
910 PRINT"SCORE"S;TAB(15)"HIGH"H(0)TAB(29)"LIVES"M
930 PRINT""LL$R$"":FORX=1TO40:PRINTPR$;:NEXT:PRINT
940 PRINT""LL$
950 PRINT"        "TAB(33)"  "L+1""
960 I=INT(RND(U)*4):FORX=0TO3:IFTT(X,I)=>.THENPRINT""TAB(TT(X,I))T$
970 NEXT
980 LD=INT(RND(1)*4+1):LT=0
990 POKEIC,U:POKEFC,U:POKEF3,50:RETURN
1000 Q1=PEEK(IS):POKEIS,0
1010 Q2=PEEK(V0+22):POKEV0+22,199
1020 POKECL,23:PRINT:PRINTTAB(22)" PAUSED "
1030 WAITKB,60,255:WAITKB,60
1040 PRINTTAB(22)"          "
1050 POKEV0+22,Q2:POKEIS,Q1:RETURN
2000 PRINT""TAB(8)"HIGH SCORE REGISTRATION
2010 PRINTTAB(8)""
2020 GOSUB2900:PRINTTAB(10)"ENTER YOUR NAME FOR
2030 PRINTTAB(11)"HIGH SCORE TABLE.
2040 PRINTTAB(14)"";
2100 N$="":PRINT"";:POKE198,0
2110 GETK$:IFK$=""THEN2110
2120 IFK$=R$THEN2200
2130 IFK$=D$ORK$=""THEN2170
2140 IFK$<>" "ANDK$<>"."THENIFK$<"0"ORK$>"Z"OR(K$>"9"ANDK$<"A")THEN2110
2150 IFLEN(N$)>9THENK$=""
2160 N$=N$+K$:PRINTK$"";:GOTO2110
2170 IFN$=""THEN2110
2180 PRINT" ";:N$=LEFT$(N$,LEN(N$)-1):GOTO2110
2200 IFHP<4THENFORX=3TOHPSTEP-1:N$(X+1)=N$(X):H(X+1)=H(X):NEXT
2205 N$(HP)="":H(HP)=S:IFN$=""THEN8000
2210 FORX=1TOLEN(N$):K$=MID$(N$,X,1)
```



This program is available on the Telsoft service.

```
2220 IFK$>"@"ANDK$<"["THENK$=CHR
$(ASC(K$)OR128)
2230 N$(HP)=N$(HP)+K$:NEXT:GOTO8
000
2900 FORX=0TO20:FORY=50TO120STEP
10
2910 POKEF1,Y:POKEG1,64:POKEG1,6
5:NEXT:NEXT:RETURN
3000 FORX=50TO120STEP10:POKEF1,X
:POKEG1,64:POKEG1,65:NEXT:RETURN
7000 SYS36888:PRINT"  "LL$"—QQ
QQQQQQQQQQQQQQQQQQQQQ":PRINTLL$"
—Q"
7010 PRINTTAB(15)"THIS IS GEORG
E THE LOCAL A
7020 PRINTTAB(15)"PARK-KEEPER WH
O HAD JUST B
7030 PRINTTAB(11)"PUT UP THE CHR
ISTMAS TREE IN B
7040 PRINTTAB(11)"THE PARK.   DU
RING THE NIGHT B
7050 PRINTTAB(11)"A FREAK ELECTR
ICAL STORM HAS B
7060 PRINTTAB(11)"TURNED ALL  TH
E SNOWMEN INTO B
7070 PRINTTAB(11)"ROBOTS  *   TO
 GET THE POWER B
7080 PRINTTAB(11)"THEY  NEED THE
Y  HAVE STOLEN C
7090 PRINT" THE LIGHTS FROM THE
CHRISTMAS TREE AND C
7100 PRINT" GEORGE MUST TRY TO G
ET THEM BACK.@
7110 GOSUB7900
7200 POKESS,.:PRINT"  "LL$"—QQ
QQQQQQQQQQQQQQQQQQQQQ":PRINTLL$"
—Q"
7210 PRINTTAB(15)"GEORGE  HAD
SOME FLARES A
7220 PRINTTAB(15)"LEFT OVER FROM
 THE FIRE- B
7230 PRINTTAB(11)"WORKS  DISPLAY
 AND  HE FOUND B
7240 PRINTTAB(11)"THAT THESE FLA
RES WOULD MAKE B
7250 PRINTTAB(11)"THE SNOWBOTS M
ELT SO THAT HE B
7260 PRINTTAB(11)"COULD GET THE
CHRISTMAS TREE B
7270 PRINTTAB(11)"LIGHTS BACK.
THE ONLY OTHER B
7280 PRINTTAB(11)"PROBLEM  IS TH
E ICICLES THAT C
7290 PRINT" THE  SNOWBOTS CAN  M
AKE FALL FROM  THE C
7300 PRINT" TREES ONTO GEORGE !@

7310 GOSUB7900
7400 POKESS,.:PRINT"  "LL$"—QQ
QQQQQQQQQQQQQQQQQQQQQ":PRINTLL$"
—Q"
7410 PRINTP2$X$P2$L$(1)"Q"
7420 PRINTTAB(20)"S C O R I N G
"SPC(27)"————————
7430 POKESS,4:PRINTTAB(15)"QQSN
OWBOTS..... 10 POINTS
7440 POKESS,12:PRINTTAB(15)"QQI
CICLES...... 20 POINTS
7450 PRINTTAB(15)"QQPLUS BONUS
OF 50 POINTS
7460 PRINTTAB(17)"QFOR EACH LIGH
T BULB
7470 PRINTTAB(17)"QQ—————————
——————————
7480 PRINT"Q   EACH  SCREEN IS
COMPLETED WHEN ALL
7490 PRINT"Q   THE LIGHT BULBS H
AVE BEEN RETURNED
7499 GOSUB7970
7800 GOTO8000
7900 PRINTP2$X$P2$L$(1):POKESS,1

7920 TP=35934:TC=0
7930 FL=(FL+1)AND7:PRINTP2$L$(FL
/2):TP=TP+1:Q=PEEK(TP):IFQ=.THEN
7970
7935 IFQ=42THENPOKESS,3
7940 IFQ>128THENTP=TP+TM(QAND127
):GOTO7930
7950 TC=-(TC+1)*(TC<4):POKETP+CS
,TC(TC):GOTO7930
7960 GOTO7960
7970 POKECL,22:PRINT:PRINT"Q
   PRESS  RETURN  TO CONTINUE

7980 FL=(FL+1)AND7:PRINTP2$L$(FL
/4):GETK$:IFK$<>R$THEN7980
7990 RETURN
8000 POKEIS,.:POKESS,.:PRINT"QQQ
Q"SS$:TS=0
8010 ONTS+1GOTO8100,8200,8300,84
00
8020 TS=(TS+1)AND3
8040 POKECL,20:PRINT:PRINT"QQQQQ
 QRESS  F1  TO START THE GA
ME ";
8050 PRINT"QQQQQQQQQQQQQQQ OR
F3  FOR INSTRUCTIONS Q"
8060 FORTD=1TOTW:SYSKC:NEXT:GOTO
8010
8100 SYS36880
8120 POKESS,255:FORX=0TO7:FORY=0
TO13:POKEV1+2*X,Y*8
8130 GOSUB1:SYSKC:NEXT:POKEV1+2*
X,96:NEXT
8140 FORX=5TO49:POKEC1,SC(X/10):
GOSUB1:SYSKC:NEXT
8150 PRINT"QQQ"SPC(13)"————————
———————":GOSUB1
8160 PRINT"QQQ"SPC(12)"Q  EITH
 UDDICK ":GOSUB1:GOSUB1
8170 PRINT"QQQ"SPC(19)"———":GOSU
B1
8180 PRINT"QQQ"SPC(18)"Q |Y "
8190 FORX=0TO11:GOSUB1:SYSKC:NEX
T:TW=1000:GOTO8020
8200 FORY=96TO50STEP-1:POKEQY,Y:
SYSTY
8210 GOSUB1:SYSKC:POKEC2,2+(YAND
4):NEXT
8220 POKESZ,0:PRINT"QQQQ"SPC(8)"
Q————————————————
8230 PRINTSPC(8)"| Q| \ | |  ● -
 ┌ _ ‾ ● Q|
8240 PRINTSPC(8)"└———————————
————————Q
8250 FORX=0TO4:PRINTTAB(8)"QQ"X+
1"QQQQQ   Q"N$(X)TAB(30-FNL(H(X
)))"Q"H(X)
8260 SYSKC:NEXT:TW=1200:GOTO8020

8300 POKEC2,6:FORY=50TO0STEP-2:P
OKEQY,Y:SYSTY:GOSUB1:SYSKC:NEXT
8310 PRINT"QQQQQQQQQQQ":SYS36884:
FORX=1TO39:PRINTPR$;:NEXT
8320 PRINTP1$X$"QQQ"TAB(27)T1$
8340 POKESS,1:FORX=80TO0STEP-1:P
OKEV0,X:POKESP,8+(XAND4)/2
8350 SYSKC:PRINTP1$L$((XAND8)/8)
:NEXT
8360 POKESS,3:FORX=0TO80:POKEV0+
2,X:PRINTP1$L$((XAND8)/8):SYSKC:
NEXT
8370 PRINTP1$L0$:FORX=80TO0STEP-
2:POKEV0+2,X:SYSKC:NEXT
8380 POKESS,1:FORX=0TO80:POKEV0,
X:POKESP,9+(XAND4)/2:SYSKC:NEXT
8390 PRINT"Q":TW=400:GOTO8020
8400 FORX=1TO25:GOSUB1:SYSKC:NEX
T:PRINT"QQQQQQQQQQ"
8410 FORX=1TO39:PRINTPR$;:NEXT:M
L=FF-CD
8420 PRINT"QQQ"TAB(10)T1$"QQQ"TA
B(28)T1$
8430 POKESZ,2:POKEV0+29,2:POKEV1
,150:POKESS,3
8440 FORX=0TO340STEP4:POKEV0+16,
```

(listing continued on page 83)


The Commodore 128.
When you look at the facts they do seem to weigh rather heavily in our favour.
When you add it up, the Commodore 128 is really three computers in one.
It can run 64K, 128K and CP/M software. Giving it the largest range of computer software in the world. Making it as efficient in business as it is entertaining at home.
That's why Commodore has become the world leader in microcomputers.
And why, on balance, the Commodore 128 has no equal.
commodore

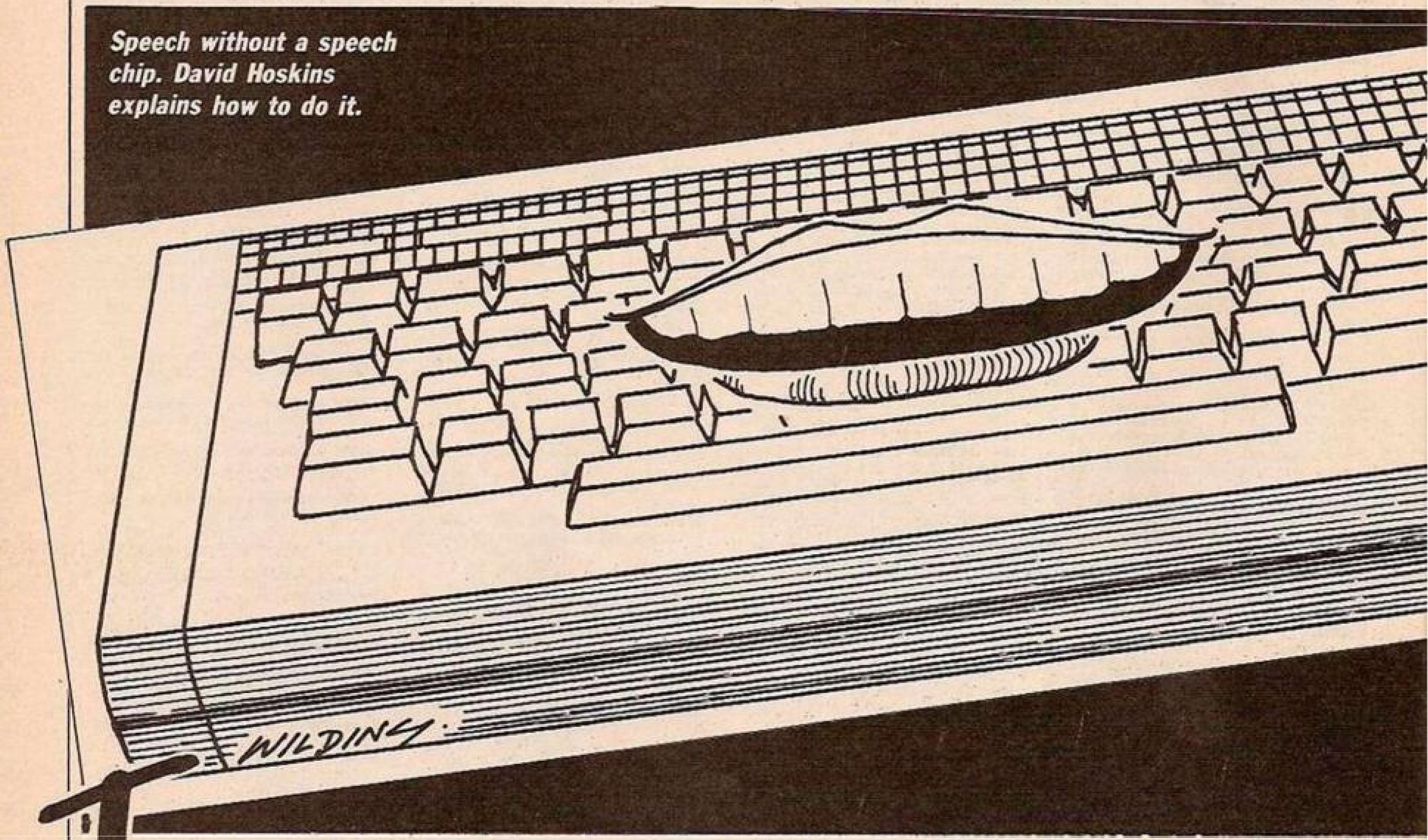
Snowbot

(listing continued from page 81)

```
-2*(X>FF)-(X>ML):POKEV0+2,XANDFF
:SYSKC
8450 POKESP,9+(XAND16)/8:POKEV0,
(X+CD)ANDFF:NEXT:POKESZ,1:POKEV0
+29,1
8460 POKEV1+2,150:POKEV1,130:POK
ESS,3:FORX=340TO0STEP-4
8470 POKEV0+16,-(X>ML)-2*(X>FF):
POKEV0+2,XANDFF:POKEV0,(X+CD)AND
FF
8480 SYSKC:POKESP,8+(XAND16)/8:N
EXT:FORX=CDTO0STEP-2:SYSKC
8490 POKEV0,X:POKESP,8+(XAND2):N
EXT:POKESS,0:TW=400:GOTO8020
9000 POKE53280,.:POKE53281,.:PRI
NT"[graphics]"
9010 LC=LOG(10):DEFFNL(X)=INT(LO
G(X)/LC)
9020 L2=LOG(2):DEFFNB(X)=INT(LOG
(X)/L2)
9030 DIMTT(3,3)
9100 U=1:T=20:T1=19:FF=255
9110 SS=53269:C1=53285:C2=C1+1:S
Z=53271:V0=53248:V1=53249
9120 L1=218:UL=140:CL=214:SP=368
56:FC=691:FX=251
9130 QY=820:TY=36928:CD=48:KC=36
944:IQ=.031
9140 CS=19456:S2=53278:LP=36882:
BY=V0+15:KB=197
9150 IS=37378:SM=679:IC=693:ID=3
7958:IX=V0+12:IY=V1+12
9160 SD=54272:F1=SD+1:F2=SD+8:F3
=SD+15
9170 G1=SD+4:G2=SD+11:G3=SD+18
9200 R$=CHR$(13):D$=CHR$(20)
9210 P1$="[graphics]":P2$="
[graphics]"
9220 T$="[graphics]
[graphics]
[graphics]"
9230 PR$="[graphics]":T1$="[graphics]
[graphics]
[graphics]"+T$
9240 L$(0)="[graphics]
[graphics]"
9250 L$(1)="[graphics]
[graphics]"
9260 LO$="[graphics]
[graphics] "
9270 LL$="[graphics]
[graphics]"
9280 FORX=1TO40:SS$=SS$+CHR$(160
):NEXT
9299 :
9300 FORX=0TO4:N$(X)="[graphics]
":H(X)=1000:NEXT
9399 :
9400 FORX=0TO4:READSC(X):NEXT
9410 FORY=0TO3:FORX=0TO3:READTT(
X,Y):NEXT:NEXT
9420 FORX=0TO4:READTC(X):NEXT
9430 FORX=1TO3:READTM(X):NEXT
9440 FORY=0TO2:FORX=0TO1:READXS(
X,Y):NEXT:NEXT
9450 FORY=0TO7:FORX=0TO2:READYS(
X,Y):NEXT:NEXT
9460 FORX=0TO7:READLC(X):NEXT
9490 FORX=1TO3:READA$:X$=X$+A$:N
EXT
9500 FORX=0TO24:READC:POKESD+X,C
:NEXT
9900 W1=32768:W2=36864:Q=16383:I
FPEEK(767)=165THEN9999
9910 PRINTTAB(14)"[graphics]PLEA
SE WAIT
9920 PRINTTAB(14)"[graphics]
9930 FORX=W1TO33727:READC:CK=(CK
+C)ANDQ:POKEX,C:NEXT
9940 CQ=12227:QQ=1:IFCK<>CQTHEN9
970
9950 FORX=W2TO37971:READC:CK=(CK
+C)ANDQ:POKEX,C:NEXT
9960 CQ=4967:QQ=2:IFCK=CQTHENPOK
E767,165:GOTO9999
9970 PRINT"[graphics]CHECKSUM ERROR :"C
K"("CQ")":PRINT"[graphics] - IN PART"QQ
9980 POKE797,0:END
9999 SYS36896:PRINT"[graphics]":GOTO8000
10000 DATA0,11,12,15,1
11000 DATA0,10,20,30,10,30,-1,-1
,0,14,20,-1,4,15,30,-1
11010 DATA0,10,14,7,13
11020 DATA55,51,41
11030 DATA1,1,1,2,2,2
11040 DATA0,0,1,0,1,1,0,0,2,0,1,
2,1,1,2,0,2,2,1,2,2,2,2,2
11050 DATA2,9,7,5,6,4,14,15
12000 DATA"[graphics]
[graphics]"
12010 DATA"[graphics]
[graphics]
[graphics]"
12020 DATA"[graphics]
[graphics]
[graphics]"
13000 DATA0,0,0,0,64,39,0
13010 DATA0,0,0,0,16,39,0
13020 DATA0,0,0,0,128,41,0
13030 DATA0,0,0,15
15000 DATA0,0,0,0,85,0,1,255,64,
7,255,208,31,255,240,31
15010 DATA195,240,31,0,240,31,0,
0,31,64,0,31,213,0,31,255
15020 DATA64,3,255,208,0,255,240
,0,3,240,0,0,240,5,1,240
15030 DATA31,65,240,31,215,240,3
1,255,240,3,255,192,0,255,0,255
15040 DATA0,0,0,5,0,80,31,1,240,
31,65,240,31,193,240,31
15050 DATA193,240,31,209,240,31,
241,240,31,241,240,31,241,240,31
,245
15060 DATA240,31,61,240,31,61,24
0,31,61,240,31,15,240,31,15,240
15070 DATA31,15,240,31,15,240,31
,3,240,31,3,240,31,3,240,255
15080 DATA0,0,0,0,85,0,1,255,64,
7,255,208,7,255,208,31
15090 DATA195,240,31,195,240,31,
0,240,31,0,240,31,1,240,31,1
15100 DATA240,31,1,240,31,1,240,
31,1,240,31,1,240,31,65,240
15110 DATA31,215,240,31,215,240,
3,255,192,3,255,192,0,255,0,0
15120 DATA0,0,0,20,0,20,124,0,12
4,124,0,124,124,0,124,124
15130 DATA0,124,124,0,124,124,0,
124,124,0,124,124,0,124,124,0
15140 DATA124,124,0,124,124,20,1
24,124,125,124,124,125,124,124,2
55,124
15150 DATA124,255,124,15,255,240
,15,195,240,15,195,240,3,0,192,6
4
15160 DATA0,0,0,5,84,0,31,253,0,
31,255,64,31,255,192,31
15170 DATA15,192,31,7,192,31,7,1
92,31,23,192,31,95,192,31,255
15180 DATA0,31,252,0,31,255,0,31
,15,192,31,7,192,31,7,192
15190 DATA31,23,192,31,95,192,31
,255,192,31,255,0,31,252,0,0
15200 DATA0,0,0,5,85,80,31,255,2
40,31,255,240,31,255,240,0
15210 DATA124,0,0,124,0,0,124,0,
0,124,0,0,124,0,0,124
15220 DATA0,0,124,0,0,124,0,0,12
4,0,0,124,0,0,124,0
15230 DATA0,124,0,0,124,0,0,124,
0,0,124,0,0,124,0,35
15240 DATA0,0,0,0,48,0,0,252,0,3
,187,0,3,155,0,3
15250 DATA223,0,3,223,0,0,252,0,
0,48,0,0,252,0,3,239
15260 DATA0,3,239,0,15,255,192,1
5,239,192,15,239,192,15,255,192
15270 DATA15,239,192,15,239,192,
3,255,0,3,255,0,0,252,0,0
15280 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
15290 DATA0,0,0,0,0,0,0,0,0,0,0,
0,89,64,0,89
15300 DATA64,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0
15310 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
15320 DATA0,1,64,0,5,80,0,21,80,
0,62,160,0,206,224,0
15330 DATA254,224,0,63,224,0,15,
0,0,53,64,62,150,64,14,150
15340 DATA64,0,22,64,0,22,64,0,2
9,64,0,29,64,0,5,0
15350 DATA0,5,0,0,5,0,0,5,0,0,42
,0,0,42,0,255
15360 DATA0,80,0,1,84,0,1,85,0,2
,175,0,2,236,192,2
15370 DATA239,192,2,255,0,0,60,0
,0,107,0,0,106,188,0,90
15380 DATA176,0,85,0,0,85,0,0,85
,0,0,85,0,0,20,0
15390 DATA0,20,0,0,20,0,0,20,0,0
,42,0,0,42,0,255
15400 DATA0,1,64,0,5,80,0,21,80,
0,62,160,0,206,224,0
15410 DATA254,224,0,63,224,0,15,
0,0,53,64,0,150,128,62,150
15420 DATA160,14,149,108,0,21,76
,0,21,64,0,5,64,0,5,64
15430 DATA0,20,64,0,20,80,0,80,0
0,0,160,160,0,160,160,255
15440 DATA0,80,0,1,84,0,1,85,0,2
,175,0,2,236,192,2
15450 DATA239,192,2,255,0,0,60,0
,0,91,0,0,106,0,2,90
15460 DATA188,14,86,176,12,85,0,
0,85,0,0,84,0,0,84,0
15470 DATA0,69,0,1,69,0,1,65,64,
2,130,128,2,130,128,255
15480 DATA0,192,0,0,204,0,0,252,
0,0,252,0,0,252,0,0
15490 DATA252,0,0,120,0,0,120,0,
0,120,0,0,56,0,0,56
15500 DATA0,0,56,0,0,48,0,0,16,0
,0,16,0,0,16,0
15510 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
15520 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
15530 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
15540 DATA0,124,0,0,124,85,2,111
,85,130,127,171,90,90,85,90
15550 DATA26,85,0,0,0,0,0,0,0,0,
0,0,0,0,0,0
15560 DATA0,0,0,0,12,0,0,0,0,12,
12,12,0,0,0,3
15570 DATA12,48,0,0,0,0,204,192,
0,0,0,51,51,51,0,0
15580 DATA0,0,204,192,0,0,0,3,12
,48,0,0,0,12,12,12
15590 DATA0,0,0,0,12,0,0,0,0,0,0
,0,0,0,0,0
16000 DATA120,160,46,189,0,145,1
57,0,208,232,136,16,246,76,144,1
44
16010 DATA162,0,240,236,162,64,2
08,232,162,128,208,228,162,192,2
08,224
16020 DATA173,2,221,9,3,141,2,22
1,173,0,221,41,252,9,1,141
16030 DATA0,221,169,140,141,136,
2,169,53,141,24,208,208,50,234,2
34
16040 DATA173,52,3,162,15,157,0,
208,202,202,16,249,96,234,234,23
4
16050 DATA165,197,201,4,240,5,20
1,5,240,5,96,162,23,208,2,162
16060 DATA27,169,8,134,122,133,1
23,96,234,234,234,234,234,234,23
4,234
16070 DATA120,169,127,141,13,220
,169,1,141,26,208,169,255,141,25
,208
16080 DATA173,13,220,169,146,162
,0,142,20,3,141,21,3,88,96,0
16090 DATA232,160,7,189,0,145,15
3,240,143,232,136,16,246,88,96,2
34
16100 DATA0,40,80,120,160,200,24
0,0,240,200,160,120,80,40,0,0
16110 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
16120 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
16130 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
16140 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
16150 DATA0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0
16160 DATA90,0,114,0,138,0,164,0
,190,0,212,0,234,0,255,0
16170 DATA0,27,0,0,0,0,200,255,5
5,255,241,0,255,0,0,0
16180 DATA240,240,241,242,243,24
0,242,241,242,243,244,245,246,24
7,248,0
16190 DATA0,5,2,4,3,2,1,0,0,0,0,
0,0,0,0,0
16200 DATA88,130,0,130,130,0,164
,0,190,0,212,0,234,0,255,0
16210 DATA1,27,0,0,0,0,200,255,5
3,255,241,0,255,3,0,0
16220 DATA240,240,241,242,243,24
2,255,246,240,243,244,245,246,24
7,248,0
16230 DATA0,0,0,0,0,0,6,0,0,0,0,
0,0,0,0,0
16240 DATA114,66,160,154,120,90,
120,116,0,0,0,0,0,0,0,0
16250 DATA0,27,0,0,0,0,200,0,53,
255,241,0,7,0,0,0
16260 DATA240,240,241,242,243,24
2,255,246,240,240,252,241,241,24
1,241,0
16270 DATA0,0,0,0,12,6,6,0,0,0,0
,0,0,0,0,0
16280 DATA160,160,160,160,0,0,0,
0,0,0,0,0,0,0,0,0
16290 DATA0,27,0,0,0,127,199,0,5
3,255,241,0,63,0,0,0
16300 DATA240,240,241,242,243,24
2,241,246,247,240,240,240,240,25
2,248,0
16310 DATA0,12,6,6,6,6,7,0,0,0,0
,0,0,0,0,0
16320 DATA120,169,0,240,31,173,1
8,208,48,13,165,251,141,22,208,1
69
16330 DATA130,141,18,208,76,192,
147,169,199,141,22,208,169,66,14
1,18
16340 DATA208,76,0,147,169,27,14
1,17,208,169,255,141,25,208,173,
13
16350 DATA220,208,3,76,129,234,7
6,49,234,0,0,0,0,0,0,0
16360 DATA173,240,140,72,173,240
,216,72,162,160,189,79,140,157,0
0,140
16370 DATA189,79,216,157,80,216,
189,239,140,157,240,140,189,239,
216,157
16380 DATA240,216,202,208,229,16
0,6,190,160,144,189,120,140,157,
80,140
16390 DATA189,120,216,157,80,216
,136,16,238,173,144,141,141,104,
141,173
16400 DATA144,217,141,104,217,10
4,141,241,216,104,141,241,140,16
9,32,141
16410 DATA144,141,76,50,147,0,0,
0,0,0,0,0,0,0,0,0
16420 DATA173,239,140,72,173,239
,216,72,160,160,162,0,189,80,140
,157
16430 DATA79,140,189,80,216,157,
79,216,189,240,140,157,239,140,1
89,240
16440 DATA216,157,239,216,232,13
6,208,228,173,103,141,141,143,14
1,173,103
16450 DATA217,141,143,217,160,6,
190,160,144,189,79,140,157,119,1
40,189
16460 DATA79,216,157,119,216,136
,16,238,104,141,238,216,104,141,
238,140
16470 DATA76,80,147,0,0,0,0,0,0,
0,0,0,0,0,0,0
16480 DATA173,240,143,41,13,168,
173,0,220,73,255,41,15,240,79,23
0
16490 DATA181,174,1,208,74,144,5
,224,112,144,1,202,74,144,5,224
16500 DATA215,176,1,232,142,1,20
8,166,251,74,133,254,144,18,160,
8
16510 DATA232,224,200,208,31,132
,182,76,64,146,164,182,162,192,2
08,20
16520 DATA70,254,144,16,160,9,20
2,224,191,208,9,132,182,76,160,1
46
16530 DATA164,182,162,199,165,18
1,41,8,208,2,200,200,134,251,140
,248
16540 DATA143,173,179,2,240,36,2
06,179,2,201,1,240,21,173,180,2
16550 DATA208,8,206,2,208,206,2,
208,208,64,238,2,208,238,2,208
16560 DATA208,56,173,21,208,41,2
53,141,21,208,173,0,220,41,16,20
0
16570 DATA41,173,240,143,41,1,14
1,180,2,169,32,141,179,2,173,1
16580 DATA208,141,3,208,169,160,
141,2,208,173,21,208,9,2,141,21
16590 DATA208,162,128,142,18,212
,232,142,18,212,76,36,146,0,0,0
16600 DATA169,32,133,252,162,6,1
89,167,2,240,93,0,41,127,133,253
16610 DATA173,16,208,37,252,133,
180,160,189,4,208,40,40,8,24,101
16620 DATA253,144,9,200,176,6,56
,229,253,176,1,136,157,4,208,196
16630 DATA180,240,8,173,16,208,6
9,252,141,16,208,189,160,2,8,41
16640 DATA127,133,253,189,5,208,
40,40,14,24,101,253,201,215,144,
21
16650 DATA72,165,253,9,128,208,1
0,56,229,253,201,112,176,7,72,16
5
16660 DATA253,157,160,2,104,157,
5,208,70,252,202,202,224,254,208
,180
16670 DATA173,30,208,240,2,133,2
,173,181,2,240,21,206,181,2,238
16680 DATA13,208,238,13,208,169,
0,208,5,206,12,208,208,3,238,12
16690 DATA208,76,36,146
```

BBC English

Speech without a speech chip. David Hoskins explains how to do it.



The BBC has very easy to use and versatile sound facilities. The envelope command enables you to change the pitch and volume of any sound played. But there is one draw-back, you cannot change the actual waveform of the sound. So you always get that spikey, tinny kind of sound that's always recognisable as a BBC.

Digitise speech

About six months ago I was very impressed by some speech on a Commodore 64 game, and wondered if it was possible to do it on the BBC. The first problem — and quite a big one — was to find a way of encoding a waveform so I can literally play from the BBC speaker! I will briefly explain how this can be achieved.

First, set the sound chip to its highest possible frequency, which is inaudible to the human ear. The more channels used the louder the waveform will be. The waveform which varies in amplitude from 0 to 15 is then sent nibble by nibble to the volume control of each channel. The fastest speed the BBC can do this is about 10000 times a second, the faster you go the clearer the sound will become. What was needed now was the waveform data to feed the program. To do this I used the Interbeeb module from DCP Microdevelopments which sampled — recorded — data at a rate of 10000 times per second, this was perfect for the job. After many weeks of frustration and fiddling I eventually had a result . . .

"It worked!" I exclaimed and ran downstairs to tell everyone. The scope for experiment was awesome. I spent a long time recording and playing sounds, at different speeds, backwards, with an echo, while mixing with other sounds, making drum beats, and even playing tunes with samples like some £280000+ synthesisers!

I had digitised about five seconds of music at a high sample rate, and it was now playing through the BBC's speaker under complete software control!

To digitise speech I use a sampling rate of about 5.5KHz and a filter to cut out any unwanted sounds above that frequency. I speak the words into a microphone which are then converted from analogue form to digital by the Interbeeb, and sent to the BBC which in turn stacks the data in memory. The data can then be saved and played back any time without using any hardware.

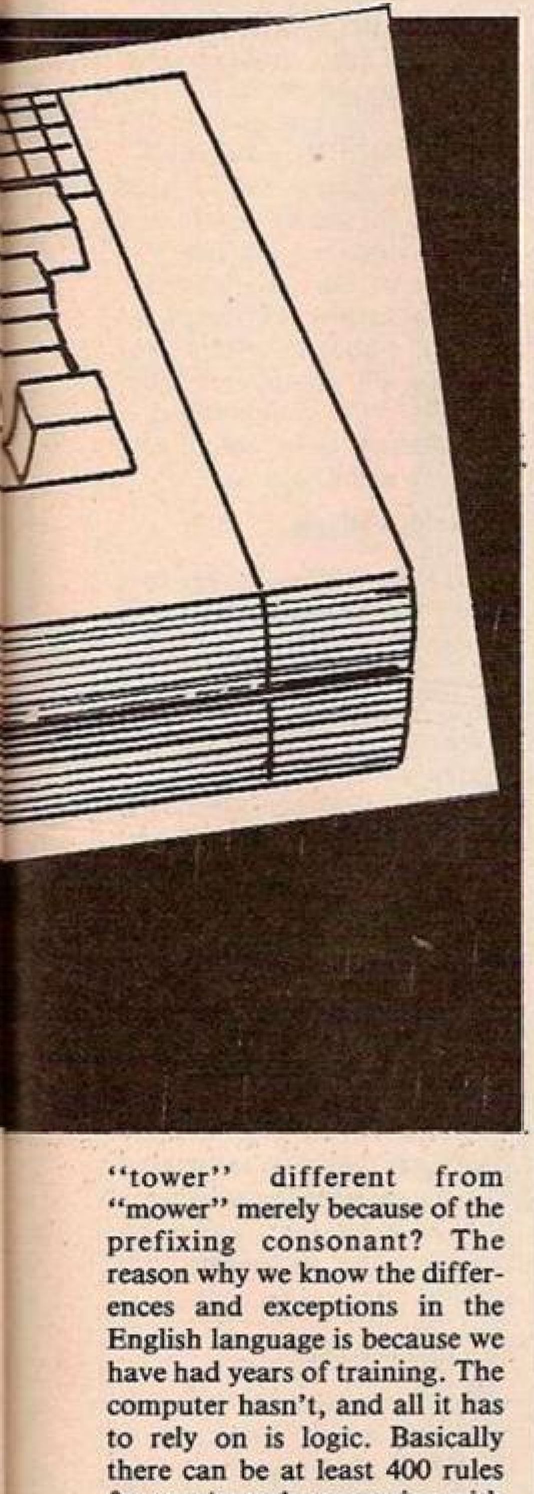
A phoneme solution

Since then I have been developing a program called Speech! which is being marketed by Superior Software. This system allows the user to type in English or phoneme phrases (explained later), which are then spoken by the program, e.g. *SAY Hello I am a speech synthesiser. The above command can be typed directly to the computer or put into a program. Speech! will translate this command and speak it through the BBC's speaker.

This program, like a few hardware systems on the market, has an unlimited vocabulary. So how did I manage to digitise every word in the English language in 32K?

The answer is in phonemes: the sounds that we string together in order to make speech. Take the words "mat" and "cat" for example, they both use exactly the same "a" sound. So in the sentence "The *cat sat* on the *mat*" all the "a" sounds can be just one block of speech data. The same thing applies to the "t"'s, "th"'s, "e"'s, and so on until you have covered as many phonemes needed for understandable speech. In Speech! I have used 49 different phonemes, which are merged to form whatever word or sentence you like.

Unfortunately to convert English phrases into phoneme data is a little more complicated. The trouble with the English language is that it is occasionally very illogical. For instance, the word "laughter" almost completely changes pronunciation when an "s" is prefixed to make "slaughter". Why is the word "rough" different from "bough" and



"tower" different from "mower" merely because of the prefixing consonant? The reason why we know the differences and exceptions in the English language is because we have had years of training. The computer hasn't, and all it has to rely on is logic. Basically there can be at least 400 rules for text/speech conversion with a few thousand exceptions! Obviously to fit Speech! into 7.5K I have cut down on the exceptions, but any mispronounced words can be easily altered with a little thought.

Glottal pulse

To digitise each phoneme sound that uses the vocal chords for speech, i.e. "OO" not "S" I prolonged the sound (like when the doctor says "Say aaahh") into the microphone and sampled a small section of it On analysis it can be seen that there is a close repetition in the waveform, every time the vocal chords produce what is known as a glottal pulse. By changing the pitch of my voice with the highest sample rate my program could handle I found that I could get the waveform to repeat every 128 samples. Unfortunately it is very difficult to remember and keep a steady pitch of voice throughout the recordings and it took many hours to complete the voiced — glottal pulse phonemes — sounds.

Voiced fricatives

Explosive sounds like "P" or "D" as in "*D*ear" never repeat so the 128 sample waveform is only played once. But this is not all. Before we make the explosive sound air pressure is built up behind the lips, making a slight pause before pronunciation. This pause was reconstructed just before playback of the phoneme. Similarly, because a relatively small sample of the sound was taken a small pause was also needed after the phoneme as well.

The biggest problem with sampling and repeating waveforms is that it does not work with fricatives. These are phonemes which use "white noise" or resonanted hiss e.g. "S" as in "*S*alt". Voiced fricatives use the resonant hiss but are also overlayed by a glottal pulse waveform. You cannot use the BBC's own white noise generator because it has only one set sound and doesn't resemble any of the phonemes.

To get around this problem I digitised 128 samples of spoken fricative, which fitted nicely into the rest of the data and could be easily tabled. To play the fricative Speech! picks a random number between 0 and 127 along the data of the sound and then plays a waveform block of 16 samples from that point. The process is then repeated by choosing the random number again. This is continued until the desired time of the phoneme is over. The result is quite an accurate reproduction of the original fricative. The only problem left (soundwise) was the voiced fricatives.

No white noise

I found that it was possible to say these phonemes and not actually sound the white noise into the microphone. After digitising and tabling this sound I worked out that the fricative

(continued on next page)

```
 10 REM      Waveform Encoded strange sounds program
 20 REM               (C) 1985 DAVID J. HOSKINS
 30 REM                   for YOUR COMPUTER
 40 REM    line 110 inserts sinewave into waveform table
 50 REM    this can be changed to create any sound
 60 REM    once data is in memory line may be skipped
 70
 80 MODE4
 90 PROCinit
100 MOVE0,448
110 FORA%=0TO255:Y%=7.9+8*SINRAD(360/256*A%)
120 DRAWA%*4,Y%*64:A%?table=Y%:NEXT
130 CALLstart
140 END
150
160 DEFPROCinit                              :REM assemble code
170 temp=&71:table=&4000:sped=&70
180 tim=&72:coun=&74
190 FOR pass=0 TO 2 STEP2:P%=&4100
200
210 OPT pass
220
230.start
240
250 SEI
260 LDA #193:JSR in:LDA #0:JSR in      \ set up sound channels
270 LDA #129:JSR in:LDA #0:JSR in      \  "    "    "      "
280 LDA #161:JSR in:LDA #0:JSR in      \  "    "    "      "
290 LDA #0
300 STA tim
310 STA tim+1
320 STA sped
330
340.loop
350 LDY #0
360 STY coun
370
380.loop2
390 LDA table,Y
400 AND #15
410 JSR send
```

(listing continued on next page)

(listing continued from previous page)

```
420 LDA tim
430 AND #127
440 CLC
450 ADC #1
460 TAX
470.wait
480 DEX
490 BNE wait
500 TYA
510 CLC
520 ADC sped
530 TAY
540 CLC
550 ADC #3
560 STA tim
570 DEC coun
580 BNE loop2
590 LDA sped
600 AND #7
610 ADC tim+1
620 ADC tim
630 STA sped
640 INC tim+1
650 BNE loop
660 CLI
670 RTS
680
690.send \send
    wave form
    to sound
    chip
700
710 EOR #15
720 STA temp
730 ORA #208
740 JSR in
750 LDA temp
760 ORA #144
770 JSR in
780 LDA temp
790 ORA #176
800 JSR in
810 RTS
820
830.in
840
850 LDX #255
860 STX &FE43
870 STA &FE41
880 INX
890 STX &FE40
900 LDA &FE40
910 ORA #8
920 STA &FE40
930 RTS
940
950é
960 NEXT
970 ENDPROC
```

(continued from previous page)

sound could be added to tne waveform after it has played one section of about 100 samples. For example, in the phoneme "Z" as in "ZEBRA" SPEECH! plays about 100 samples of the wave (without the hiss) and then it plays 28 samples of the fricative "S". The reason why "S" was used in the phoneme "Z" was because it's sharp and loud, whereas "V" would need a mellow and quiet sound like "H" — as in "House".

Vary the pitch

The user of Speech! can also control the overall pitch of the voice and individual phonemes. Inserting full-stops and question marks vary the pitch of the voice towards the end of the sentence. To change pitch Speech! simply plays back the phoneme at different speeds. But . . . the problem was that when you change pitch of the voice in the phrase it suddenly changes where it should vary slowly. Also, after a voiced phoneme was played it suddenly jumped into the next one usually making it very hard to understand at the best of times! What was need was some kind of merging technique which will slowly change one waveform into another while they are playing.

Fairly accurate

With the phonemes "AA" in "*Yard*" and "EE" as in "*Feet*", the merging was achieved as follows. When the "AA" phoneme starts, 128 samples are played and then 0 samples of "EE". Then 127 samples of "AA" are played and 1 of "EE". This continues until the end of the "AA" phoneme when 0 samples are played of "AA" and 127 of "EE", you see! This merge is timed to finish exactly when the first phoneme has completed its cycle, no matter how long it is played. The result is a gradually varied and fairly accurate reproduction of speech.

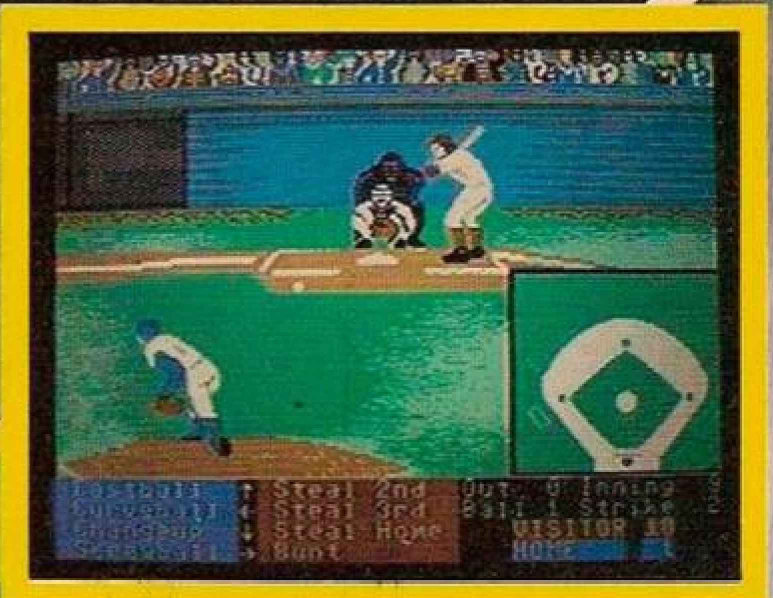
An example of Speech! can be heard on two games from Superior Software: Citadel and Repton 2. Speech! and six programs and utilities can be bought at £9.95 on tape and £11.95 on disk. ●

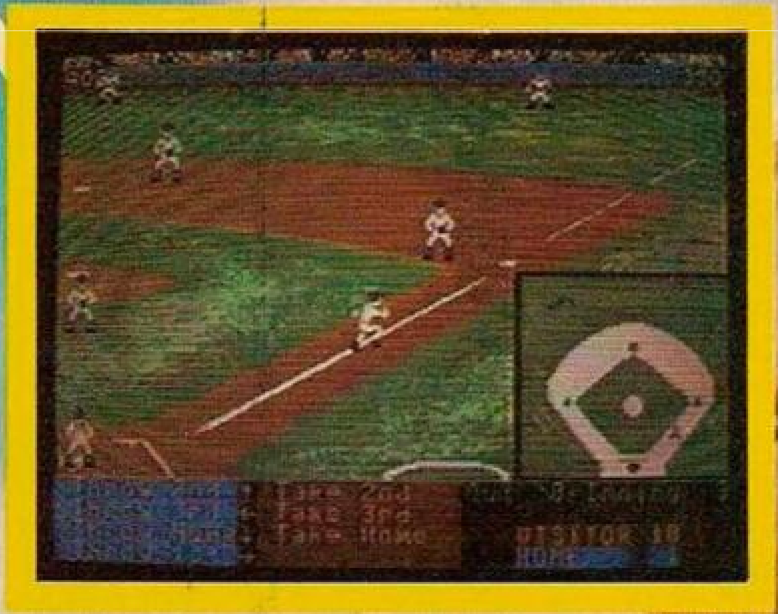


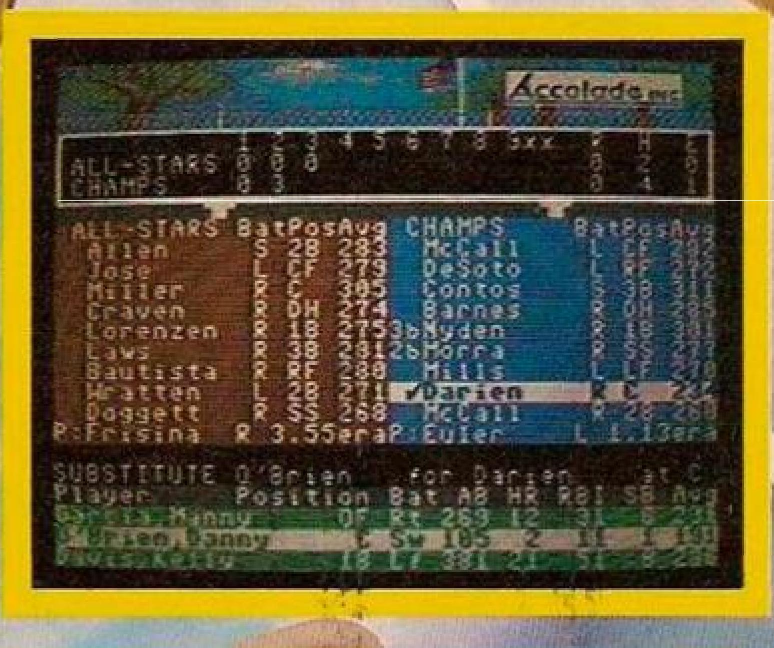
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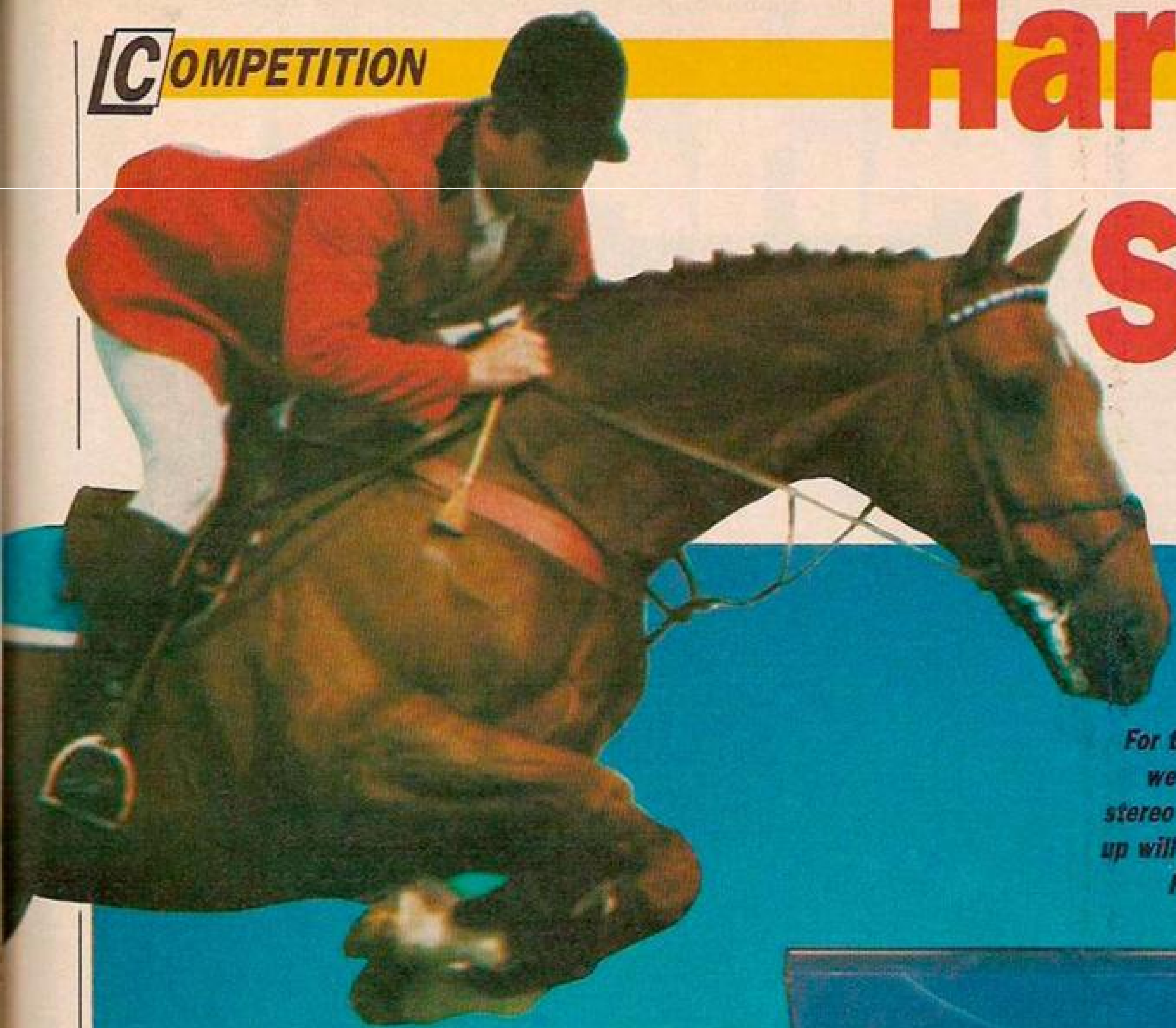
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- The names of the winners will be printed in the March issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in January 1986.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
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Android 2 inf/Lives	Load Game. When asked for keyboard or Joystick. Press Cap and Break. Enter POKE 52249,24:POKE 52250, 32:POKE 53897,0. Enter Cont.
Arcadia	POKE 23776,0 or POKE 25776,0
inf/lives	POKE 26197,0 Stops the Rubbish.
Cookie	POKE 35730,52
Defenda	10 CLEAR 24100
Fall Guy	11 LOAD "" CODE 12 RANDOMISE USR 65100 13 LOAD "" CODE 14 POKE 44204,0 15 RANDOMISE USR 41200 Type in and Run then play tape.
Frank N Stein	Type in and Run. 10 BORDER: INK 0: CLEAR 24750: LOAD ""SCREEN$: PAPER 0: PRINT AT 0,6; :LOAD ""CODE: POKE 28287,X: RANDOMISE USR 27890. (X=No of Lives) POKE 28277,0: POKE 28278,0 inf/lives. For no title screen POKE 34124,0 inf/lives with title screen.
Ground Attack	POKE 29063,0
Horace Goes Skiing	POKE 29270,0 removes traffic. POKE 30027,0: POKE 30644,0 no charge for skis.
Hunchback	POKE 26888,0
Jet-Pac	POKE 25020,0 inf/lives Poke 26075,0 1 fuel pod to launch rocket.
Kokotoni Wilf	Type in and run the load tape. 10 CLEAR 24100: LOAD""CODE 20 RANDOMISE USR 65100: LOAD""CODE 30 POKE 42214,X : PRINT USR 41200 (X=No of Lives)
Kosmic Kanga	POKE 36212,0
Lazy Jones	Alter Line 335 to POKE 56693,0 enter Goto 9999 and restart tape
Lunar Jetman	POKE 36965,0 inf/lives POKE 37999,201 no enemies
Moon Alert	10 POKE 23693,0: CLS: LOAD "" SCREEN$:LOAD""CODE 24756: POKE 42404,255: Print USR 26624.
Other Pokes	POKE 39754,0 inf/lives POKE 37035,201 no enemies in the air POKE 42654,195 immortality.
Mr Wimpy	POKE 33501,0 skip first screen POKE 33693,0 inf/lives
Mutant Monty	POKE 54933,0 gives 2556 lives
Piballed	POKE 46441,0
PSSST	POKE 24984,0
TranzAm	POKE 25446,0
Zzoom	POKE 24743,0:POKE 32692,0
Atic Atac	POKE 36519,0 inf/lives. First Merge"" POKE 23756,1, Enter, list, then put in inf/lives Poke.
Black Crystal	Map References. 1. 512661220 2. 1126690200 3. 1126671220 4. 3126641220 5. 2126671220 6. 1126290200

Freez Bees	POKE 34610,0
Pyramid	POKE 44685,0
Tutankhamun	POKE 27783,0
Wheelie	Codes, 1. Witty 2. Shark 3. Bebop 4. Xenon 5. ZX83B 6. 2MQL3 7. HRME2.
Helichopper	Passwords. Show. Forever. Restart. Clear.
Booty	Type in and Run. The Start Tape. 10 BORDER 0: PAPER 0: INK 0 20 CLEAR 26870 30 LOAD "" SCREEN$ 40 LOAD "" CODE 26880 50 RANDOMISE USR 26880 60 POKE 58294,0 70 RANDOMISE USR 52500
Wizards Lair	Codes for lift. 1. HAWLO 2. CAIVE 3. VAULT 4. LIAYR 5. DUNGN 6. CRYPT 7. LYONS.
Spectral Invaders	POKE 25062,254
Short Fuse	Codes 1. 000 2. 367 3. 157 4. 049 5. 281
Fantastic Voyage	Type in and Run to load the code. 10 CLEAR 30791: LOAD "VOYAGE" CODE: POKE 54492,167: BORDER 0: PRINT USR 53248.
Cauldron	Type in and run, start tape just past screen. 10 CLEAR 24599: FOR f=23296 TO 23309: READ a: POKE f,a: NEXT f. 20 LET L = USR 23296: POKE 40060,0: LET L = USR 24600. 30 DATA 221,33,24,96,17,232,159,62,255, 55,205,86,5,201.
Sky Ranger	Codes 1. Enter 2. Magic 3. Pilot 4. Stomp 5. Paris 6. Event 7. Recap
River Rescue	POKE 33420,0 player 1 POKE 33452,0 player 2
Zaxxon	POKE 48825,255
Cavern Fighter	POKE 31683,0: POKE 31684,0
Black Hawk	POKE 34695,183
A View to a Kill	Add to line 30 before the Rand USR command POKE 28032,255: POKE 28087,8: POKE 29243,8: POKE 30543,8
Project Future	POKE 27662,2
Road Racer	POKE 27150,0
Ah Diddums	POKE 24786,0
Orion	POKE 37319,201
Zip Zap	POKE 54065,0
Jet Set Willy 2	Type in and Run then start tape. 10 CLEAR 64999 20 LET obj = 150 30 LET room = 32 40 For n = 65000 To 65047:READ a:POKE n, a: NEXT n 50 PAPER 0: INK 0: BORDER 0: CLS 60 RANDOMISE USR 65000 70 DATA 221,33,0,64,17,56,185,62,255, 55,205,86,5,243,48,240 80 DATA 33,6,254,17,197,100,1,59,0,237, 176,195,0,95 90 DATA 62,255,50,67,117 100 DATA 62,obj,50,126,135 110 DATA 62,room,50,75,117 120 DATA 195,0,112

Make it live

James Hartley shows you how to control six adventure characters.

In last month's instalment I showed you one way of programming tree structures in Basic. This month, in order to show you the system working on a rather larger scale, we've provided a listing that uses it to control six characters.

Margaret Thatcher, Ronald Reagan, Catherine the Great of Russia, Hamlet, Count Dracula, and Godzilla are all guests at the Hotel Horrabelle. They can discuss their favourite subjects with one another; pick up, drop, and give objects; and indulge in other less conventional activities. To see them in action, simply enter the program and Run it.

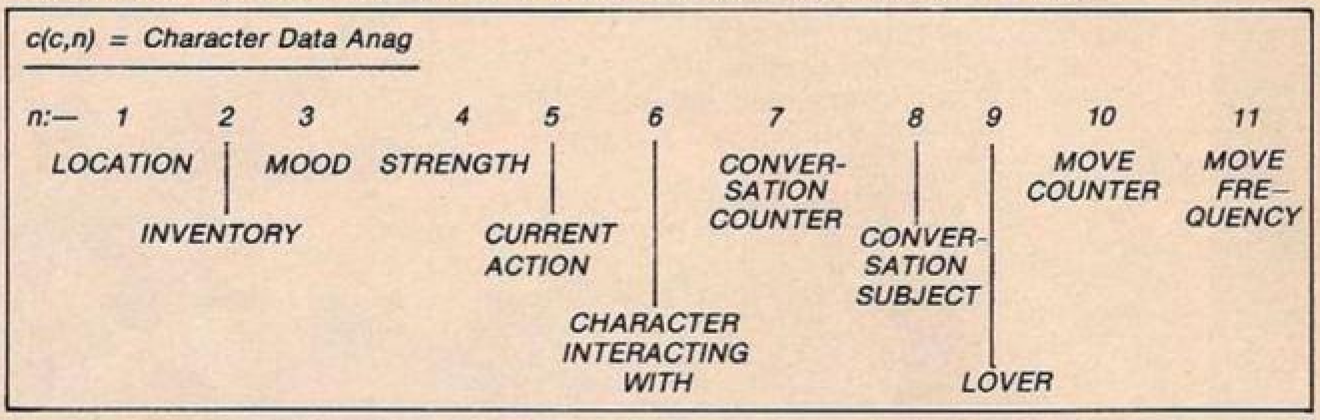
Controlling characters in this way is only one aspect of the vast subject of "data structures" and their use in programming. The "trees" we have built are really only a type of linked list which enable items to be stored in memory in some relation to each other that enables them to be sorted and processed by a simple algorithm. If you're serious about programming then you could try getting a book on the subject and your programming will benefit enormously.

The Hotel Horrabelle example is not as efficient as it could be for a number of reasons. First, it's written in minimal Basic and sacrifices the good features of most machines for the standard features they all share (with one or two exceptions). Second, it's rather slow in execution since it's been written with more attention to ease of comprehension than to speed.

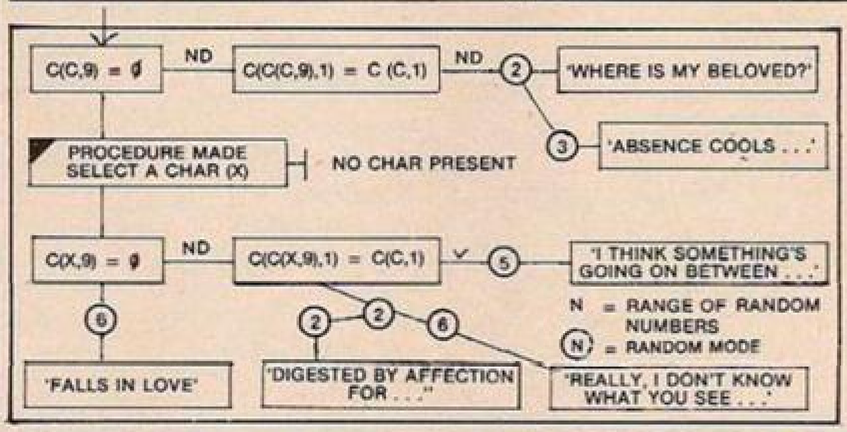
It's worth noting that this method of handling characters is in fact even better suited to machine code than to Basic, and machine code programmers would find it very easy to program the tree traversal algorithm in lines 1070 to 1210 together with the tree data to gain obvious benefits in speed.

Large areas of program could also be condensed, in particular by putting sub-messages in data statements and then using either string functions or sub-routines to compile the statements. Perhaps the most practical solution of all, if you wish to make serious use of this technique without getting into machine code, is to condense the program as much as possible and then compile it, though of course you could only do this if there is a suitable compiler available for your machine.

This approach is adopted by at least one adventure software company I know.



		t(t,n,1)	t(t,n,2)	t(t,n,3)	t(t,n,4)
CHOICE		1	CONDITION NUMBER	BRANCH IF FALSE	BRANCH IF TRUE
ACTION TERMINAL		2	ACTION NO.	Ø	Ø
RANDOM/MULTIPLE CHOICE		3	CONDITION NUMBER	RND NO RANGE	BASE NODE
PROCEDURE		4	PROC NO	Ø	Ø
RANDOM BRANCH TO ONE NODE		5	Ø	RND NO RANGE	NODE TO TO JUMP



Main variables.
c — current character
x — character interacting with
d(n) — conditions
c(c,n) — character data
a — player's position
v$(n) — location descriptions
b$(n) — object descriptions
t(tree no., node no., data) — the arrays

Program Notes.

The program allows the user to input numbers 1 to 4, which will select different locations. You can then see what's going on in that location. Messages are only printed on the screen about the characters in the location you are currently viewing. If you'd like to know what's going on in all the rooms, just delete line 750.

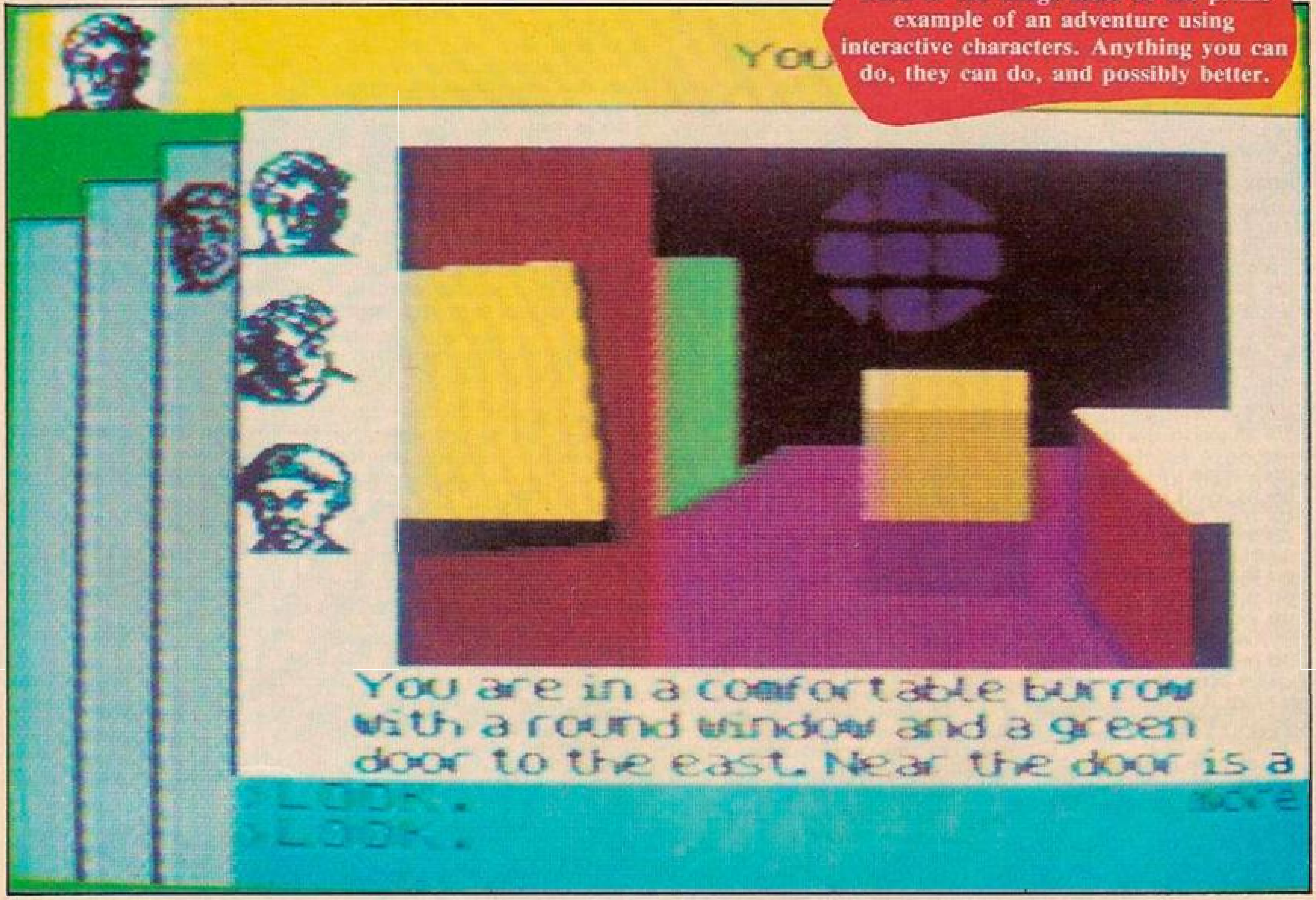
The program as written will run unaltered on the Amstrad range of computers. However, other micro users may have to make some minor corrections. Spectrum owners will have to alter the string dimension statements, giving the maximum length of the elements involved. They will also have to replace the ON . . . GOTO/GOSUB statements with the following construct:
RESTORE (line number): FOR N = 1 to (branch variable): READ D: NEXT N: GOTO D
(line number) DATA . . . list of line numbers . . .

BBC owners will also have to make slight alterations to the syntax of the random number routine in line 1330 and Commodore owners will also need to alter the CLS routine in line 1270. The input routine in line 450 may also need minor alteration for some micros.

The program sets up five trees as described in the previous issue's article. Each node has four data values associated with it — a node type, followed by three parameters. The note types are (1) a simple choice node (2) an action terminal node (3) a multiple choice node (either a random choice or as dictated by a condition) (4) a 'procedure node' which exits the tree and then re-enters it and (5) a random node that branches to a given node only if a specified number is returned from the random number generator.

You could experiment with adding your own trees if you wished. The program is designed to call one of seven trees at random , but only five are implemented. Trees six and seven could be introduced by altering line 2700 and adding the data, action routines, and procedure routines to the different tables. A diagram of the 'falling in love' tree is shown as an example.

Lord of the Rings must be the prime example of an adventure using interactive characters. Anything you can do, they can do, and possibly better.




```
10 REM Welcome to the Hotel Horrabelle!
20 REM
30 REM Initialise
40 REM
50 GOSUB 1270
60 PRINT "Welcome to the Hotel Horrabelle ..."
70 PRINT "The guests include Margaret Thatcher, Godzilla, Hamlet, and others"
80 PRINT "Please wait while I call them from their rooms..."
90 DIM r$(4),r(4,4),b$(10),b(10),c$(6),c(6,11),t(7,35,4),d(50)
100 DIM s$(6)
110 DEF FNs$(f$,g$,h$)=CHR$(34)+h$+CHR$(34)+" says "+f$+" to "+g$
120 DEF FNq$(f$,g$)=CHR$(34)+g$+CHR$(34)+" says "+f$
130 REM read in data
140 FOR n=1 TO 4: READ r$(n): FOR m=1 TO 4: READ r(n,m): NEXT m: NEXT n
150 FOR n=1 TO 10: READ b$(n),b(n): NEXT n
160 FOR n=1 TO 6: READ c$(n): FOR m=1 TO 11: READ c(n,m): NEXT m: NEXT n
170 FOR n=1 TO 6: READ s$(n): NEXT n
180 REM tree one
190 FOR n=1 TO 13: FOR m=1 TO 4: READ t(1,n,m): NEXT m: NEXT n
200 REM tree number two - object manipulation
210 FOR n=1 TO 27: FOR m=1 TO 4: READ t(2,n,m): NEXT m: NEXT n
220 REM tree number three - conversation
230 FOR n=1 TO 35: FOR m=1 TO 4: READ t(3,n,m): NEXT m: NEXT n
240 REM tree number four - love
250 FOR n=1 TO 21: FOR m=1 TO 4: READ t(4,n,m): NEXT m: NEXT n
260 REM tree number five - actions
270 FOR n=1 TO 31: FOR m=1 TO 4: READ t(5,n,m): NEXT m: NEXT n
280 REM
290 REM main loop
300 REM
310 a=1
320 GOSUB 1260: REM clear the screen
330 GOSUB 490: REM print location
340 GOSUB 510: REM print objects
350 GOSUB 600: REM print characters
360 GOSUB 450: REM check for keypress
370 IF p=0 GOTO 390: REM no keypress so carry on
380 a=p: GOSUB 1350: GOTO 330: REM change player location
390 GOSUB 2660: REM call the character handler
400 GOTO 360: REM carry on
410 REM
420 REM high level subroutines
430 REM
440 REM input
450 i$=INKEY$: IF i$="" THEN p=0: RETURN
460 IF (ASC(i$)<49) OR (ASC(i$)>52) THEN p=0: RETURN
470 p=ASC(i$)-48: RETURN
480 REM print location description
490 PRINT r$(a): GOSUB 1350: RETURN
500 REM print visible objects
510 m=0
520 FOR n=1 TO 10
530 IF b(n)<>a THEN GOTO 560
540 IF m=0 THEN PRINT "You can see: a ";b$(n);: m=1: GOTO 560
550 PRINT ", a ";b$(n);
560 NEXT n
570 IF m=0 THEN RETURN
580 GOSUB 1350: RETURN
590 REM print visible characters
600 m=0: FOR n=1 TO 6
610 IF c(n,1)<>a THEN GOTO 640
620 IF m=0 THEN PRINT "Also present: ";c$(n);: m=1: GOTO 640
630 PRINT ", ";c$(n);
640 NEXT n
650 IF m=0 THEN PRINT "There's no-one here..."
660 GOSUB 1350: RETURN
670 REM move a character
680 y=0:r=5: GOSUB 1330: IF r(c(c,1),r)=0 THEN GOTO 680
690 IF c(c,1)=a THEN m$=c$(c)+" leaves the room...": l=1: GOSUB 750: y=1
700 c(c,1)=r(c(c,1),r)
710 IF c(c,1)=a THEN m$=c$(c)+" enters the room...": l=1: GOSUB 750: y=1
720 IF y=1 THEN GOSUB 600
730 RETURN
740 REM print a message if player present
750 IF c(c,1)<>a THEN m$="": RETURN
760 PRINT m$;: IF l=1 THEN GOSUB 1350
770 l=0: m$="": RETURN
780 REM select a random character from a location
790 x=0: m=0
800 FOR n=1 TO 6
810 IF n=c THEN GOTO 850
820 IF c(n,1)<>c(c,1) THEN GOTO 850
830 r=6: GOSUB 1330: IF r=5 THEN x=n: n=6
840 m=1
850 NEXT n: IF m=0 THEN RETURN
860 IF x=0 THEN GOTO 800
870 RETURN
880 REM select a random object from a location
890 b=0: m=0
900 FOR n=1 TO 10
910 IF b(n)<>c(c,1) THEN GOTO 940
920 r=5: GOSUB 1330: IF r=4 THEN b=n: n=10
930 m=1
940 NEXT n: IF m=0 THEN RETURN
950 IF b=0 THEN GOTO 900
960 RETURN
970 REM check if object owner present
980 x=0: p=0: IF (c(c,2)=0) OR (c(c,2)>6) THEN RETURN
990 IF c(c(c,2),1)=c(c,1) THEN p=1: x=c(c,2)
1000 RETURN
1010 REM check if owned object present
1020 p=0: IF b(c)=c(c,1) THEN p=7: RETURN
1030 FOR n=1 TO 6
1040 IF (c(n,2)=c) AND (c(n,1)=c(c,1)) THEN p=c: n=6
1050 NEXT n: RETURN
1060 REM sort a tree
1070 j=1
1080 ON t(t,j,1) GOTO 1090,1110,1150,1180,1210
1090 j=t(t,j,(ABS(d(t(t,j,2)))+3)): IF j=0 THEN RETURN
1100 GOTO 1080
1110 IF t(t,j,2)=0 THEN GOTO 1130
1120 GOTO 1460
```

(continued on next page)

Make it live

(continued from previous page)

```
1130 IF t(t,j,4)=0 THEN RETURN
1140 m$=m$(t(t,j,4)): l=1: GOSUB 1410: RETURN
1150 IF t(t,j,2)=0 THEN GOTO 1170
1160 j=t(t,j,4)+ABS(d(t(t,j,2))): GOTO 1000
1170 r=t(t,j,3): GOSUB 1330: j=r+t(t,j,4): GOTO 1000
1180 IF t(t,j,2)=0 THEN GOTO 1200
1190 GOSUB 2340: GOTO 1000
1200 m$=m$(t(t,j,4)): l=1: GOSUB 1410: j=t(t,j,3): GOTO 1000
1210 r=t(t,j,3): GOSUB 1330: IF r=1 THEN j=t(t,j,4): GOTO 1000
1220 RETURN
1230 REM
1240 REM low level subroutines
1250 REM
1260 REM clear screen
1270 CLS: RETURN
1280 REM beep
1290 PRINT CHR$(7);: RETURN
1300 REM test for a keypress
1310 i$=INKEY$: RETURN
1320 REM generate a variable random number
1330 r=INT(RND(1)*r): RETURN
1340 REM print a blank line
1350 PRINT: PRINT: RETURN
1360 REM convert first letter of word to caps
1370 IF ASC(LEFT$(p$,1))<97 OR ASC(LEFT$(p$,1))>123 THEN oops=6175: GOTO 3050
1380 a$=LEFT$(p$,1): b$=RIGHT$(p$,LEN(p$)-1): a$=CHR$(ASC(a$)-32)
1390 p$=a$+b$: RETURN
1400 REM print a message regardless
1410 PRINT m$: IF l=1 THEN GOSUB 1350
1420 l=0: m$="": RETURN
1430 REM
1440 REM action jumpblock
1450 REM
1460 ON t(t,j,2) GOTO 1500,1530,1540,1550,1560,1580,1600,1610,1640,1660
1470 ON (t(t,j,2)-10) GOTO 1680,1690,1710,1730,1740,1760,1770,1790,1810
1480 ON (t(t,j,2)-19) GOTO 1830,1850,1870,1910,1930,1940,1960,1990,2010
1490 ON (t(t,j,2)-28) GOTO 2030,2050,2070,2090,2110,2150,2170,2230,2250,2270
1500 c(c,10)=c(c,11): IF c(c,7)=0 GOTO 1520
1510 m$=c$(c)+" loses interest in the conversation and walks off.": GOSUB 750
1520 c(c,7)=0: c(c,8)=0: c(c,6)=0: GOSUB 680: RETURN
1530 t=2: RETURN
1540 c(c,7)=0: c(c,8)=0: c(c,6)=0: t=2: RETURN
1550 r=5: GOSUB 1330: t=r+3: RETURN
1560 GOSUB 890: IF b=0 THEN RETURN
1570 c(c,2)=b: b(b)=0: m$=c$(c)+" picks up a "+b$(b): l=1: GOSUB 750: RETURN
1580 m$="I think this is your "+b$(c(c,2))
1590 m$=FNs$(c$(c),c$(c(c,2)),m$): l=1: GOSUB 750: RETURN
1600 m$=c$(c)+" is carrying a "+b$(c(c,2)): l=1: GOSUB 750: RETURN
1610 m$=c$(c)+" drops a "+b$(c(c,2)): b(c(c,2))=c(c,1)
1620 c(c,2)=0: l=1: GOSUB 750
1630 RETURN
1640 m$=c$(c)+" has got the "+b$(c(c,2))+" belonging to "+c$(x): l=1
1650 GOSUB 750: RETURN
1660 c(x,2)=c(c,2): c(c,2)=0: m$=c$(c)+" gives the "+b$(c(x,2))+" to "+c$(x)
1670 l=1: GOSUB 750: RETURN
1680 m$=c$(c)+" is arguing with "+c$(c(c,5)): l=1: GOSUB 750: RETURN
1690 m$=c$(c)+" is winning an argument with "+c$(c(c,5)): l=1: GOSUB 750
1700 RETURN
1710 m$=" sees "+c$(x)+" talking to "+c$(c(x,5))+" and fumes with jealousy"
1720 m$=c$(c)+m$: l=1: GOSUB 750: RETURN
1730 m$=c$(c)+" tries to interrupt "+c$(x): l=1: GOSUB 750: RETURN
1740 m$=c$(c)+" gazes lovingly into "+c$(x)+"'s eyes...": l=1: GOSUB 750
1750 RETURN
1760 m$="Love blossoms between "+c$(c)+" and "+c$(x): l=1: GOSUB 750: RETURN
1770 m$=FNs$(c$(c),c$(x),"Why don't you talk about "+s$(c))
1780 l=1: GOSUB 750: RETURN
1790 m$=FNs$(c$(c),c$(x),"You're talking nonsense")
1800 l=1: GOSUB 750: RETURN
1810 m$=FNs$(c$(c),c$(x),"Ridiculous, but I agree entirely")
1820 l=1: GOSUB 750: RETURN
1830 m$=FNs$(c$(c),c$(x),"I think "+s$(c)+" is more important")
1840 l=1: GOSUB 750: RETURN
1850 m$=c$(c)+" tries to join in the discussion between "+c$(x)
1860 m$=m$+" and "+c$(c(x,5)): l=1: GOSUB 750: RETURN
1870 m$=c$(c)+" talks to "+c$(x)+" about "+s$(c(c,8)): l=1: GOSUB 750
1880 IF c(c,8)=c THEN GOTO 1900
1890 m$=c$(c)+" however, does not appear to be enjoying the conversation"
1900 l=1: GOSUB 750: RETURN
1910 m$="A brisk discussion begins between "+c$(c)+" and "+c$(x)
1920 m$=m$+" on the subject of "+s$(c(c,8)): l=1: GOSUB 750: RETURN
1930 m$=c$(c)+" and "+c$(x)+" talk about "+s$(c(c,8)): l=1: GOSUB 750: RETURN
1940 m$=c$(c)+" desperately tries to attract the attention of "+c$(x)
1950 m$=m$+" by indulging in small talk": l=1: GOSUB 750: RETURN
1960 IF c(x,9)=c THEN RETURN
1970 m$="I think there's something going on between "+c$(x)+" and "
1980 m$=m$+c$(c(x,9)): m$=FNq$(c$(c),m$): l=1: GOSUB 750: RETURN
1990 m$=c$(c(x,9)): m$=FNs$(c$(c),c$(x),"I don't know what you see in "+m$)
2000 l=1: GOSUB 750: RETURN
2010 m$=c$(x)+"'s affection for "+c$(c(x,9))+" dampens the ardour of "+c$(c)
2020 l=1: GOSUB 750: c(c,9)=0: RETURN
2030 m$=c$(c)+" is suddenly overcome with love for "+c$(x): l=1: GOSUB 750
2040 c(c,9)=x: RETURN
2050 m$=c$(c(c,9)): m$=FNq$(c$(c),"Where is my beloved "+m$)
2060 l=1: GOSUB 750: RETURN
2070 m$=c$(c)+" goes down before "+c$(c(c,9))+" and pleads everlasting love..."
2080 l=1: GOSUB 750: RETURN
2090 m$="Absence cools the passion of "+c$(c)+" for "+c$(c(c,9))
2100 l=1: GOSUB 750: c(c,9)=0: RETURN
2110 m$=c$(c)+" suddenly jumps upon "+c$(x)+" and sinks his teeth into "
2120 IF (x=3) OR (x=4) THEN m$=m$+"her ": GOTO 2140
2130 m$=m$+"his "
2140 m$=m$+"neck": l=1: GOSUB 750: c(x,4)=c(x,4)-1: RETURN
2150 m$=FNq$(c$(c),"Alas, poor Yorick..."): m$=m$+", holding up the skull"
2160 l=1: GOSUB 750: RETURN
2170 m$=c$(c)+", thinking she is back home, threatens everyone with exile"
2180 m$=m$+" to Siberia.": l=1: GOSUB 750: m$="The room empties rapidly..."
2190 l=1: GOSUB 750
2200 FOR n=1 TO 6: IF n=3 THEN GOTO 2220
2210 c(n,10)=0
2220 NEXT n: RETURN
2230 m$=c$(x)+" swayed by the logic of the Iron Lady, agrees to buy."
2240 l=1: GOSUB 750: c(x,2)=c(c,2): c(c,2)=0: RETURN
2250 m$=FNq$(c$(c),"This hat is my proudest possession!"): l=1: GOSUB 750
2260 RETURN
2270 m$=FNq$(c$(c),"Urk...Grurk...Banana!!"): l=1: GOSUB 750: RETURN
2280 m$=c$(c)+" collapses from loss of blood.": l=1 GOSUB 750
2290 m$="The hotel staff rush in and remove the body...": l=1: GOSUB 750
2300 c$(c)=" the body of "+c$(c): c(c,1)=0: RETURN
2310 REM
2320 REM procedure jumpblock
2330 REM
2340 ON t(t,j,2) GOTO 2360,2370,2390,2420,2440,2460,2470,2480,2500,2530
2350 ON (t(t,j,2)-10) GOTO 2550,2570,2590,2610
2360 c(c,10)=c(c,10)-1: j=6: RETURN
2370 c(c,7)=c(c,7)-1: IF c(c,7)=0 THEN GOSUB 1210
2380 j=13: RETURN
2390 IF c(c,7)=0 THEN GOTO 2410
2400 m$=c$(c)+" is discussing "+s$(c(c,8))+" with "+c$(c,6): l=1: GOSUB 750
2410 j=11: RETURN
2420 GOSUB 980: IF p=0 THEN j=9: RETURN
2430 j=10: RETURN
2440 IF c(x,2)=0 THEN j=24: RETURN
2450 j=26: RETURN
2460 c(c,3)=(c(c,3)-1) MOD 5: j=4: RETURN
2470 c(c,3)=(c(c,3)+1) MOD 5: j=7: RETURN
2480 GOSUB 790: IF x=0 THEN j=10: RETURN
2490 GOSUB 2760: j=11: RETURN
2500 c(c,5)=x: c(x,5)=c: r=3: GOSUB 1330: c(c,7)=r+1: c(x,7)=r+1
2510 IF d(11) THEN c(c,8)=c: c(x,8)=c: j=29: RETURN
2520 c(c,8)=x: c(x,8)=x: j=29: RETURN
2530 GOSUB 790: IF x=0 THEN j=21: RETURN
2540 GOSUB 2760: j=3: RETURN
2550 GOSUB 790: IF p=0 THEN j=8: RETURN
2560 j=9: GOSUB 2760: RETURN
2570 GOSUB 790: IF p=0 THEN j=14: RETURN
2580 j=15: GOSUB 2760: RETURN
2590 GOSUB 790: IF p=0 THEN j=19: RETURN
2600 j=21: GOSUB 2760: RETURN
2610 m$=c$(c)+", in order to further privatisation, tries to sell "
2620 m$=m$+"the "+b$(c(c,2))+" to "+c$(x): l=1: GOSUB 750: RETURN
2630 REM
2640 REM character handler
2650 REM
2660 FOR c=1 TO 6: REM process each character
2670 IF c(c,4)=0 THEN GOSUB 2280
2680 t=1: REM start with tree one
2690 GOSUB 2760: z=t: GOSUB 1070: IF z=t THEN GOTO 2730: REM endif no transfer
2700 IF t<6 THEN GOTO 2720
2710 GOTO 2730
2720 GOSUB 2760: GOTO 2690: REM traverse next tree
2730 NEXT c
2740 RETURN
2750 REM conditions
2760 d(1)=(c(c,1)=0): d(2)=(c(c,4)=0): d(3)=(c(c,10)=0): d(4)=(c(c,7)>0)
2770 d(5)=(c(c,2)=0): d(6)=1: d(7)=(c(c,2)=c): d(8)=(c(c,8)=c)
2780 d(9)=(c(x,7)=0) AND (c(x,7)<>c): d(10)=(c(c,9)=x): d(11)=(c(c,4)>c(x,4))
2790 d(12)=(c(x,9)=c): d(13)=(c(c,9)=0): d(14)=(c(x,9)=0)
2800 d(15)=(c(c(x,9),1)=c(c,1)): d(16)=(c(c(c,9),1)=c(c,1))
2810 d(17)=c-1: d(18)=(c(x,2)=0)
2820 RETURN
2830 REM
2840 REM data
2850 REM
2860 REM location descriptions
2870 DATA "The Lobby. Guests crowd round the reception desk...",0,4,2,0
2880 DATA "The Restaurant.  There are a number of empty tables...",1,3,0,0
2890 DATA "The Bar...propped up by numerous travelling salesman.",4,0,0,2
2900 DATA "The Reading Room. Newspapers everywhere and a haze of tobacco smoke"
2910 DATA 0,0,3,1
2920 REM object descriptions
2930 DATA "coffin",0,"skull",0,"sword",0,"dole cheque",0,"cowboy hat",0
2940 DATA "banana",0,"carving knife",3,"bloody Mary",4
2950 DATA "bottle of Bull's Blood",4,"pint of bitter",4
2960 REM character descriptions
2970 DATA "Count Dracula",1,1,5,5,0,0,0,0,0,10,10
2980 DATA "Hamlet Prince of Denmark",4,2,5,5,0,0,0,0,0,6,15
2990 DATA "Catherine the Great",4,3,5,5,0,0,0,0,0,5,14
3000 DATA "Margaret Thatcher",1,4,5,5,0,0,0,0,0,0,19
3010 DATA "Ronald Reagan",2,5,5,5,0,0,0,0,0,12,15
3020 DATA "Godzilla",3,6,5,5,0,0,0,0,0,20,0
3030 DATA "leeches","the meaning of life","Russian history"
3040 DATA "politics","cowboys","grape picking"
3050 GOSUB 1290: PRINT "Error in line "; oops: STOP
3060 REM tree number one
3070 DATA 1,1,2,0,1,2,3,0,1,3,5,4,2,1,0,0,4,1,0,0,1,4,12,7,4,2,0,0
3080 DATA 2,2,0,0,2,2,0,0,4,3,0,0,2,2,0,0,2,3,0,0,3,0,2,8
3090 REM object tree data
3100 DATA 3,0,2,2,2,4,0,0,1,5,7,5,1,6,0,0,5,0,3,6,2,5,0,0,1,7,0,15
3110 DATA 4,4,0,0,5,0,3,13,3,0,4,11,1,6,0,0,2,6,0,0,3,0,2,22,3,0,3,19
3120 DATA 5,0,2,16,3,0,2,17,2,7,0,0,2,8,0,0,2,9,0,0,1,6,0,0,4,5,0,0
3130 DATA 1,6,0,0,2,8,0,0,5,0,2,25,2,10,0,0,5,0,4,27,2,11,0,0
3140 REM conversation tree
3150 DATA 1,4,9,2,1,8,3,6,4,6,0,0,5,0,4,5,2,11,0,0,4,7,0,0,5,0,4,8
3160 DATA 2,12,0,0,4,8,0,0,1,6,0,0,1,9,12,15,1,10,16,13,2,13,0,0
3170 DATA 4,9,0,0,1,10,14,18,1,11,23,17,2,14,0,0,1,12,33,19,3,0,3,20
3180 DATA 2,15,0,0,2,16,0,0,1,6,0,0,3,13,0,24,2,17,0,0,2,18,0,0
3190 DATA 2,19,0,0,2,20,0,0,2,21,0,0,3,0,3,30,2,22,0,0,2,23,0,0
3200 DATA 2,24,0,0,3,0,2,34,1,6,0,0,2,25,0,0
3210 REM tree number four - falling in love
3220 DATA 1,13,14,2,4,10,0,0,1,14,4,12,1,15,7,5,5,0,4,6,2,26,0,0
3230 DATA 3,0,2,8,5,0,6,10,5,0,2,11,2,27,0,0,2,28,0,0,5,0,4,13
3240 DATA 2,29,0,0,1,16,15,18,3,0,2,16,2,30,0,0,5,0,3,20,5,0,6,19
3250 DATA 2,31,0,0,2,32,0,0,1,6,0,0
3260 REM tree number 5 - actions
3270 DATA 3,17,0,2,4,11,0,0,1,7,11,12,4,12,0,0,1,5,18,17,1,7,26,27
3280 DATA 1,7,29,30,1,6,0,0,5,0,5,10,2,33,0,0,1,6,0,0,5,0,3,13
3290 DATA 2,34,0,0,1,6,0,0,5,0,3,16,2,35,0,0,1,6,0,0,5,0,3,20,1,6,0,0
3300 DATA 4,13,0,0,1,10,22,23,1,6,0,0,4,14,0,0,5,0,2,25,2,36,0,0
3310 DATA 1,6,0,0,5,0,3,20,2,37,0,0,1,6,0,0,5,0,3,31,2,38,0,0
```

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

SEAS OF BLOOD

▶ *Various • £9.95 • Adventure International*



The Fighting Fantasy (FF) gamebooks of Steve Jackson and Ian Livingstone have been a huge success. Two of these books were later used as the bases for computer games.

The first adaptation, Warlock of Firetop Mountain, was very disappointing, being an arcade game with little connection with the book. The second, The Forest of Doom, and released by Penguin books themselves, was excellent. This was virtually a straight conversion of the book's contents and in my opinion deserved far greater success than it actually achieved.

Now comes a third adaptation, Seas of Blood, from Mike Woodroffe and Brain Howarth whose earlier Gremlins and Robin of Sherwood have proved very popular.

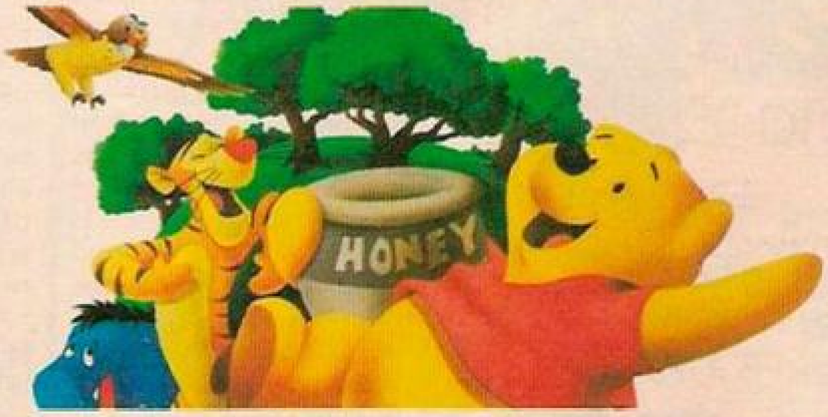
The game is in the usual text and graphics style of Adventure International, plenty of attractive pictures, locations (over 300) and puzzles.

A new element is the addition of a combat system, capturing more of the flavour of the book. This involves attributing various aspects — strength, stamina, etc — to you and your opponent and determing the outcome of combat by throwing dice.

The plot concerns Tak, a city chock-a-bloc with cut-throats, thieves, pirates and assorted dregs.

WINNIE THE POOH

▶ *Commodore 64Z/128 • Disc £14.95 • U.S. Gold*



Manufactured under license by US Gold from Walt Disney Productions, this is a very good children's adventure. Pooh has attractive graphics, is different each time it's played and is simple to use. For example, the game is controlled by selecting one course of action from several displayed on the screen at each decision point.

When the blustery wind whistles through Hundred Acre Wood, it blows objects about. The player's task is to find all the lost articles and return them to their rightful owners, including Pooh, Rabbit, Eyore and Piglet. The player must take care — Tigger is bouncing around, the mist sometimes comes down and another wind could start blowing again at any moment.

Although the game is marred by a screen glitch along the bottom border of the picture, Pooh is still a delightful adventure.

THE CRYSTAL BALL

The marvellous Infocom have released Spellbreaker, the third in the Enchanter series. It's available on disc for Commodore, Atari, Apple, IBM and others.

If you're lucky enough to own an Atari ST, you'd be well advised to buy A Mind Forever Voyaging, Infocom's 128K blockbusting adventure for this new machine.

Soul of Darkon, a text and graphics adventure from Tasket, is now available for Amstrad owners. BBC B owners might care to sample Star of the Void, a new text adventure from Black Knight Computers of Chislehurst, Kent.

A HELPING HAND

Russell Deitch of London and Tim O'Neill of Dublin have asked for assistance with the brilliant Hitch Hiker's Guide To The Galaxy:
Can't get the babel fish!

1. KOOH NONW OGTU P
2. NIAR DREV OLEW OTTU P
3. LENA PFOT NORF NILE HCTA STUP
4. LEHC TASO NLIA MKNU JTUP
5. NOTT UBSS ERP

Want a hint to prove your intelligence to the door?
AETO NDNA AETH TIWT NEMI REPX E

Craig Coomber of Aberdeenshire is troubled by The Count and Voodoo Castle.
Can't use the dumbwaiter?
TIRE WOLR OESI ARNE HTRE TIAW BMUD OG
Where is the safe combination?
EUQA LPEH TNOG NITI RWSU ONIM ULYN ITEH TDAE R
Zork 1 fans, want a smashing, alternative way of dealing with the Cyclops?
MIGT ASDUE SSYD OTUO HS
Your is Perils and Pickles
Hugo North

Transdisc

Fast, flexible efficient file copying from Geoff Hatts for CBM-64 disc-drive fans. Up to 58.4K can be transferred from one disc to another.

This program runs on a Commodore 64 with the 1541 disc drive connected and allows you to transfer files up to 58.4 Kbytes — 236 blocks — long from one disc to another. What makes this program special compared to simple file copying programs is both the presentation and the ability to change the file's parameters once the file has been loaded into the computer.

The program can copy sequential (SEQ), program (PRG) and user (USR) file types — but not relative files — and can intelligently convert from one type to another in memory. The new file can then be re-saved on disc.

The program supports a screen directory which also shows the total number of files which are displayed to the screen. A disc command facility is also included and the disc drive status can be read whilst in the main menu and is automatically updated after disc I/O.

The whole program has been designed to be extremely simple to use and is entirely menu driven with a powerful "pop-up" menu system. To select an option use the vertical cursor keys to control the cursor position and type Return.

When the program prompts for filenames and start addresses, the last entry or address which was entered is remembered and displayed on the input line. This allows simple modification of existing filenames and start addresses. If the last entry is not required then it may be removed in one keystroke by holding down the shift key and typing return. The new filename or address can then be entered.

After running the program you are presented with the main menu. The following describes each option in detail. Remember, to select an option, use the vertical cursor control keys to position the cursor and type the return key.

When you select the Load File option you are presented with a sub-menu which asks which program type you wish to load — sequential, program or user. When this has been selected, enter the desired filename followed by pressing the return key. The program will now attempt to load this file into memory. A bell sounds to indicate that the loading process has been completed.

If the disc error status — shown in the bottom display box — is OK then your file has been loaded correctly. If it says Out of Memory then the file which you attempted to load was greater than 58.4 Kbytes — 236 blocks — long. If the status line says File not Found then the file does not exist on disc — use the Directory command in the main menu to check the disc contents.

With the file loaded into memory, use the Same File option as often as required to save copies of the file to disc. A sub-menu is presented which allows you to create a new copy of the file on disc, or it allows replacement of an existing file with the same filename.

When the program is asked to replace an existing file on disc, it first erases the old copy and then creates the updated version from the file stored in memory.

This overcomes a slight problem using the @0: replace

Transdisc.

```
10 REM  *******************************
20 REM  **                           **
30 REM  **       TRANSDISK V2.0      **
40 REM  **                           **
50 REM  **  (LOADER)   G.HATTO '85   **
60 REM  **                           **
70 REM  *******************************
80 :
90 :
100 PRINT
110 PRINT"    PLACE DESTINATION DISK IN DRIVE"
120 PRINT
130 PRINT"    TYPE THE RETURN KEY WHEN READY."
140 :
150 GET CR$ :IFCR$<>CHR$(13) THEN 150
160 PRINT:PRINT:PRINT" SAVING CODE TO DISK - PLEASE WAIT."
170 :
180 OPEN 8,8,8,"TRANSDISK V2.0,PRG,W"
190 :
200 READ ADDRESS
210 BEGIN = ADDRESS
220 MAXNUMBER = 458
230 :
240 PRINT#8,CHR$(ADDRESS AND 255);
250 PRINT#8,CHR$(ADDRESS / 256);
260 :
270 DEF FN LINENUMBER(A) = PEEK(63)+PEEK(64)*256
280 :
290 PRINT
300 FOR COUNT=1 TO MAXNUMBER:GOSUB 400:READ CHECKSUM
310 IF SUM<>CHECKSUM THEN PRINT"CHECKSUM ERROR IN ";FN LINENUMBER(0):GOTO620
320 L = FN LINENUMBER(0):PRINT L
330 IF ADDRESS<>L+8 THEN PRINT"LINE NUMBER";L;" NOT IN ORDER":GOTO620
340 NEXT COUNT
350 CLOSE8
360 PRINT:PRINT:PRINT"  EXECUTABLE FILE CREATED!"
370 END
380 :
390 :
400 SUM = 0
410 FOR I=1 TO 8:READ ENTRY$
420 GOSUB 480
430 PRINT#8,CHR$(ENTRY);
440 ADDRESS = ADDRESS+1:SUM = SUM+ENTRY
450 NEXT I
460 RETURN
470 :
480 IF LEN(ENTRY$)<>2 THEN 570
490 A$ = RIGHT$(ENTRY$,1):GOSUB 530:ENTRY = V
500 A$ = LEFT$ (ENTRY$,1):GOSUB 530:ENTRY = ENTRY+V*16
510 RETURN
520 :
530 IF A$<"0" OR A$>"F" OR (A$>"9" AND A$<"A") THEN 570
540 V = ASC(A$)-48+7*(A$>"9")
550 RETURN
560 :
570 PRINT"DATA ERROR IN ";FN LINENUMBER(0)
580 :
590 :
600 REM  **** DATA ERROR DETECTED ****
610 :
620 CLOSE 8
630 OPEN  15,8,15,"S:TRANSDISK V2.0"
640 CLOSE 15
650 PRINT:PRINT:PRINT"  EXECUTABLE FILE DELETED."
660 END
670 :
680 :
690 DATA 2049
700 :
2049 DATA 2E,08,C1,07,9E,32,30,39,567
2057 DATA 36,3A,14,14,14,14,14,14,232
2065 DATA 14,14,54,52,41,4E,53,44,500
2073 DATA 49,53,4B,20,56,32,2E,30,493
2081 DATA 20,20,20,47,2E,48,41,54,442
2089 DATA 54,4F,29,0D,00,00,00,20,249
2097 DATA 84,FF,20,8A,FF,20,E7,FF,1330
2105 DATA 20,31,12,A9,0F,8D,20,D0,664
2113 DATA 8D,21,D0,A9,0D,20,D2,FF,1061
2121 DATA A9,93,20,D2,FF,A9,8E,20,1156
2129 DATA D2,FF,A9,08,20,D2,FF,A9,1308
2137 DATA 01,8D,3C,03,20,52,08,A0,490
2145 DATA 0F,A9,00,19,41,03,88,10,429
2153 DATA FA,C9,00,F0,03,20,38,08,796
2161 DATA D0,0C,8D,3D,03,8D,3E,03,631
2169 DATA 8D,3F,03,8D,40,03,20,25,484
2177 DATA 08,20,52,10,84,92,A0,06,585
2185 DATA B9,01,08,99,F9,FF,88,10,1211
2193 DATA F7,A9,0F,A8,A2,08,20,BA,987
2201 DATA FF,A9,00,20,BD,FF,20,C0,1124
2209 DATA FF,B0,34,20,B7,FF,D0,2F,1208
2217 DATA A9,00,20,34,11,A9,00,A2,609
2225 DATA 00,86,C6,20,7F,10,AA,BD,866
2233 DATA CA,08,48,BD,C3,08,48,A9,915
2241 DATA 00,60,C4,BB,60,03,A2,D6,986
2249 DATA 3F,08,09,0B,0D,0E,0E,0F,147
2257 DATA 40,F9,FF,F9,FF,F9,FF,48,1648
2265 DATA A9,0F,20,C3,FF,20,CC,FF,1157
2273 DATA 68,4C,F9,E0,AD,3C,03,A2,1051
2281 DATA 05,20,7F,10,C9,03,D0,05,597
2289 DATA A9,00,4C,B0,08,48,A9,06,676
2297 DATA 20,34,11,20,38,08,20,67,338
2305 DATA 0F,68,A4,B7,F0,EA,8D,3C,1141
2313 DATA 03,20,25,08,20,0B,0B,A9,306
2321 DATA 00,A2,00,A0,20,BA,FF,A5,984
2329 DATA 92,A2,41,A0,03,20,BD,FF,1012
2337 DATA 20,C0,FF,B0,59,A9,00,8D,1054
2345 DATA 3D,03,8D,3E,03,A2,08,20,472
2353 DATA C6,FF,B0,4A,A9,0F,20,34,971
2361 DATA 11,AD,3C,03,C9,01,D0,0E,677
2369 DATA 20,CF,FF,B0,39,8D,3D,03,932
2377 DATA 20,CF,FF,8D,3E,03,20,CF,939
2385 DATA FF,B0,28,20,AD,09,20,14,740
2393 DATA 08,B0,30,20,B7,FF,F0,EE,1183
2401 DATA 30,A5,22,E9,4A,85,22,A5,894
2409 DATA 23,E9,16,85,23,18,A5,22,681
2417 DATA 6D,3D,03,8D,3F,03,A5,23,580
2425 DATA 6D,3E,03,8D,40,03,A9,08,559
2433 DATA 20,C3,FF,20,CC,FF,A9,00,1142
2441 DATA 4C,A3,0E,A9,0E,20,34,11,537
2449 DATA A9,08,20,C3,FF,20,CC,FF,1150
2457 DATA 20,43,12,AD,3D,03,AE,3E,590
2465 DATA 03,8D,3F,03,8E,40,03,A9,588
2473 DATA 03,4C,B0,08,78,A0,34,84,727
2481 DATA 01,A0,00,91,22,A0,37,84,687
2489 DATA 01,58,60,20,B9,0A,B0,0F,603
2497 DATA A9,00,20,7F,10,C9,00,F0,785
2505 DATA 37,C9,02,D0,05,A9,00,4C,716
2513 DATA B0,08,A9,11,20,34,11,A2,633
2521 DATA 0F,20,C9,FF,B0,1F,A9,53,962
2529 DATA 20,D2,FF,B0,18,A9,3A,20,956
2537 DATA D2,FF,A5,92,F0,0F,A0,00,1191
2545 DATA B9,41,03,20,D2,FF,B0,05,931
2553 DATA C8,C4,92,D0,F3,20,CC,FF,1484
2561 DATA A2,0F,20,C9,FF,B0,0C,A9,1022
2569 DATA 10,20,34,11,A9,49,20,D2,601
2577 DATA FF,90,06,20,CC,FF,4C,A6,1138
2585 DATA 0A,20,CC,FF,A4,92,A9,2C,1024
2593 DATA 99,41,03,99,43,03,AE,3C,678
2601 DATA 03,8D,B0,0A,99,42,03,A9,769
2609 DATA 57,99,44,03,A9,00,A2,08,658
2617 DATA A0,00,20,BA,FF,18,A5,92,976
2625 DATA 69,04,A2,41,A0,03,20,BD,720
2633 DATA FF,20,C0,FF,B0,52,20,0C,1244
2641 DATA 0C,18,8A,69,4A,85,35,98,691
2649 DATA 69,16,85,36,20,00,08,A2,538
2657 DATA 00,20,C9,FF,B0,3A,A0,00,890
2665 DATA A0,3C,03,C9,01,D0,13,AD,838
2673 DATA 3D,03,20,D2,FF,B0,29,20,810
2681 DATA B7,FF,D0,24,AD,3E,03,20,952
2689 DATA D2,FF,20,FC,0A,20,D2,FF,1256
2697 DATA B0,16,20,B7,FF,D0,11,20,925
2705 DATA 14,09,B0,0C,A5,23,C5,36,670
2713 DATA 90,E8,A5,22,C5,35,90,E2,1195
2721 DATA A9,08,20,C3,FF,20,CC,FF,1150
2729 DATA A9,37,85,01,4C,A3,0E,53,694
2737 DATA 50,55,45,52,53,51,47,52,633
2745 DATA 0A,48,A0,00,A2,06,B9,41,788
2753 DATA 03,DD,E8,0A,F0,0C,CA,10,939
2761 DATA F8,C8,C4,92,90,EE,68,AA,1446
2769 DATA 18,60,48,A9,13,20,34,11,481
2777 DATA 68,20,F2,0A,09,80,8D,74,782
2785 DATA 07,20,43,12,68,AA,A9,02,569
2793 DATA 38,60,3A,3F,2A,2C,3D,40,484
2801 DATA 24,40,0A,68,29,3F,90,02,472
2809 DATA 09,40,60,78,A9,34,85,01,644
2817 DATA A0,00,B1,22,A0,37,84,01,719
2825 DATA 58,60,A9,4A,A2,16,85,22,778
2833 DATA 86,23,60,E6,22,D0,02,E6,969
2841 DATA 23,A5,23,C9,FF,D0,04,A5,1068
2849 DATA 22,C9,F8,60,A2,0F,BD,00,945
2857 DATA 02,9D,41,03,CA,10,F7,A4,856
2865 DATA B7,C0,11,90,02,A0,10,84,846
2873 DATA 92,60,20,52,00,A6,92,86,813
2881 DATA B7,F0,0A,CA,BD,41,03,9D,1049
2889 DATA 00,02,CA,10,F7,20,E3,08,737
2897 DATA 60,A9,00,85,B7,A2,27,A9,951
2905 DATA 20,9D,00,02,CA,10,F4,60,755
2913 DATA 8A,48,A9,0E,20,34,11,A9,660
2921 DATA 12,20,16,E7,A9,9A,20,16,680
2929 DATA E7,18,A2,07,A0,04,20,F0,860
2937 DATA FF,AE,3D,03,AD,3E,03,20,763
2945 DATA CD,BD,18,A2,08,A0,04,20,787
2953 DATA F0,FF,AE,3F,03,AD,40,03,975
2961 DATA 20,CD,BD,18,A2,0F,A0,04,791
2969 DATA 20,F0,FF,20,FD,0B,A9,0C,1004
2977 DATA 20,34,11,A9,98,20,16,E7,787
2985 DATA 20,38,08,20,30,10,68,AA,472
2993 DATA A9,03,20,7F,10,AA,BD,C6,904
3001 DATA 0B,48,BD,C2,0B,48,A9,00,718
3009 DATA 60,C9,EA,11,AF,00,08,0C,757
3017 DATA 08,A9,06,20,34,11,20,38,375
3025 DATA 08,20,67,0F,A4,B7,F0,03,751
3033 DATA 20,25,08,A9,03,A2,02,4C,492
3041 DATA 61,0B,18,A2,16,A0,14,4C,572
3049 DATA F0,FF,AD,3C,03,A2,04,20,929
3057 DATA 7F,10,8D,3C,03,A9,04,A2,682
3065 DATA 02,4C,61,0B,AE,3C,03,BD,612
3073 DATA B0,0A,20,16,E7,BD,B3,0A,849
3081 DATA 20,16,E7,BD,B6,0A,4C,16,764
3089 DATA E7,A9,07,20,34,11,A9,12,697
3097 DATA 20,16,E7,A9,01,20,16,E7,868
3105 DATA 18,A2,16,A0,1C,20,F0,FF,923
3113 DATA AE,3D,03,AD,3E,03,20,CD,713
3121 DATA BD,20,52,08,A0,00,B9,00,659
3129 DATA 01,F0,06,99,00,02,C8,D0,818
3137 DATA F5,18,A2,16,A0,1C,20,F0,913
3145 DATA FF,A9,05,20,79,0F,A9,3A,824
3153 DATA A4,B7,F0,BD,99,00,02,A9,1100
3161 DATA FF,A2,01,85,7A,86,7B,20,962
3169 DATA 7F,0C,B0,AD,20,79,00,D0,849
3177 DATA A0,A5,62,A6,63,85,22,86,997
```

command provided by the disc drive, which saves the updated version first and then scratches the old version. This can result in a Disc Full error when updating a file on a disc which only has a few blocks free.

If a Disc Full error should occur when using the save option do not scratch the now starred file — as it appears in the directory — or you will stand a chance of corrupting the disc. You should always validate a disc when a starred file appears in the directory. Use the Send Disc Command option in the main menu to issue a validate command. Note — this point also applies in general when saving a Basic program using the 1541 disc drive.

Use the Change File option to vary the file parameters, i.e. the program name, start address and file type. It is quite useful to be able to change the file from one type to another or a program's start address — in decimal. For example, a sequential file stored on disc can be converted by loading it into the Transdisc program and storing it back on disc with a different file name and as a program file with a start address.

This allows you to load to file straight into memory where you can inspect the contents. Remember, Basic programs are tokenised, and so not much is gained by converting them to sequential or user files. This

(continued on next page)



Nicholas Card's entry was runner-up in our September 6128 competition.

```
3185 DATA 23,20,DC,0C,20,EC,0C,A9,740
3193 DATA 03,A2,02,4C,61,08,A9,00,520
3201 DATA 85,62,85,63,20,73,00,20,642
3209 DATA A9,0C,90,10,E9,30,40,20,737
3217 DATA B3,0C,60,B0,0C,65,62,85,815
3225 DATA 62,A5,63,69,00,85,63,90,843
3233 DATA E3,A9,00,85,62,85,63,60,955
3241 DATA C9,30,90,85,E9,3A,38,E9,970
3249 DATA C6,60,40,06,62,26,63,B0,783
3257 DATA 20,A5,62,85,64,A5,63,85,925
3265 DATA 65,06,64,26,65,B0,12,06,546
3273 DATA 64,26,65,B0,0C,A5,62,65,791
3281 DATA 64,85,62,A5,63,65,65,85,930
3289 DATA 63,60,60,38,AD,3F,03,ED,831
3297 DATA 3D,03,AA,AD,40,03,ED,3E,773
3305 DATA 03,A0,60,A5,22,8D,3D,03,671
3313 DATA A5,23,8D,3E,03,18,8A,65,669
3321 DATA 22,8D,3F,03,98,65,23,8D,670
3329 DATA 40,03,60,A9,00,85,D4,20,709
3337 DATA 7F,10,C9,02,F0,6D,A2,04,861
3345 DATA 86,96,A2,24,8E,29,02,A2,829
3353 DATA 30,8E,2A,02,A2,3A,8E,28,639
3361 DATA 02,A2,2A,8E,2C,02,C9,00,595
3369 DATA F0,37,A9,0A,20,34,11,10,599
3377 DATA A2,16,A0,10,20,F0,FF,A9,1056
3385 DATA 12,20,16,E7,A9,1F,20,16,557
3393 DATA E7,20,52,05,A9,14,20,79,698
3401 DATA 0F,A4,B7,F0,14,A0,22,B9,1001
3409 DATA 00,02,99,2C,02,88,10,F7,600
3417 DATA 18,A5,B7,65,96,69,FF,85,1116
3425 DATA 96,20,B1,0D,A9,00,85,C6,824
3433 DATA 20,E4,FF,F0,FB,29,7F,C9,1375
3441 DATA 03,F0,F5,A9,93,20,16,E7,1089
3449 DATA 4C,A3,0E,A9,00,4C,B0,08,682
3457 DATA A9,FE,85,02,A9,0D,A2,08,910
3465 DATA A0,00,20,BA,FF,A5,96,A2,1110
3473 DATA 29,A0,02,20,BD,FF,20,C0,903
3481 DATA FF,B0,71,A2,0D,20,C6,FF,1204
3489 DATA B0,6A,20,CF,FF,20,CF,FF,1270
3497 DATA 20,CC,FF,A9,69,A0,0E,20,971
3505 DATA 1E,AB,A5,D6,C9,18,D0,05,1010
3513 DATA AD,8D,02,D0,07,20,16,0E,599
3521 DATA A5,90,D0,08,20,E1,FF,D0,1245
3529 DATA E9,E6,02,18,A9,0D,20,C3,098
3537 DATA FF,20,CC,FF,A9,0D,20,16,982
3545 DATA E7,20,16,E7,20,16,E7,20,833
3553 DATA 16,E7,20,34,11,18,A2,16,562
3561 DATA A0,0C,20,F0,FF,A9,12,20,910
3569 DATA 16,E7,A9,9C,20,16,E7,A6,1029
3577 DATA 02,E8,C8,90,02,A2,00,A9,903
3585 DATA 00,20,CD,BD,A9,0E,A0,0E,911
3593 DATA 20,1E,A0,60,48,A9,0D,20,615
3601 DATA C3,FF,68,38,60,A2,0D,20,913
3609 DATA C6,FF,20,59,0E,20,59,0E,723
3617 DATA E6,02,A9,20,20,D2,FF,20,962
3625 DATA D2,FF,20,D2,FF,20,59,0E,1097
3633 DATA 85,63,20,59,0E,85,62,20,630
3641 DATA D1,BD,A9,20,20,D2,FF,20,1120
3649 DATA 59,0E,A2,01,86,D4,C9,00,813
3657 DATA F0,06,20,D2,FF,4C,40,0E,897
3665 DATA 20,CC,FF,A9,0D,4C,D2,FF,1214
3673 DATA 20,CF,FF,A6,90,D0,01,60,1109
3681 DATA 60,60,60,60,18,4C,CD,0D,734
3689 DATA 0D,93,0D,1F,20,20,20,55,385
3697 DATA 53,45,20,53,48,49,46,54,566
3705 DATA 20,48,45,59,20,46,4F,52,528
3713 DATA 20,4E,4F,20,53,43,52,4F,545
3721 DATA 4C,4C,0D,0D,00,20,46,49,353
3729 DATA 4C,45,20,53,29,20,44,49,402
3737 DATA 53,50,4C,41,59,45,44,2E,576
3745 DATA 0D,00,A9,07,20,34,11,18,314
3753 DATA A2,16,A0,03,20,F0,FF,A9,1043
3761 DATA 98,20,16,E7,A9,12,20,16,678
3769 DATA E7,A2,0F,20,C6,FF,B0,13,1000
3777 DATA 20,CF,FF,20,16,E7,20,B7,994
3785 DATA FF,F0,F5,20,CC,FF,20,43,1330
3793 DATA 12,A9,00,4C,B0,08,20,CC,683
3801 DATA FF,A9,1F,A0,0F,20,1E,AB,863
3809 DATA 20,CF,FF,C9,0D,F0,20,C9,1181
3817 DATA 20,F0,F5,48,C9,4E,F0,22,1142
3825 DATA A2,0F,20,C9,FF,B0,10,60,961
3833 DATA 20,D2,FF,20,CF,FF,C9,0D,1205
3841 DATA F0,05,20,D2,FF,90,F4,A9,1299
3849 DATA 93,20,16,E7,20,CC,FF,4C,999
3857 DATA A3,0E,20,57,0F,F0,D9,A0,872
3865 DATA 20,CC,FF,4C,00,0F,1F,0D,634
3873 DATA 93,0D,0D,45,4E,54,45,52,555
3881 DATA 20,44,49,53,48,20,43,4F,509
3889 DATA 4D,4D,41,4E,44,20,53,54,564
3897 DATA 52,49,4E,47,0D,0D,00,20,362
3905 DATA 57,0F,F0,0A,A9,00,20,34,613
3913 DATA 11,A9,00,4C,B0,08,A9,0F,630
3921 DATA 20,C3,FF,4C,E2,FC,A9,12,1223
3929 DATA 20,34,11,20,43,12,20,E4,478
3937 DATA FF,F0,FB,C9,59,60,A9,1F,1332
3945 DATA 20,16,E7,A9,12,20,16,E7,757
3953 DATA 20,30,10,20,E3,0B,A9,10,551
3961 DATA 85,97,20,52,10,84,02,38,604
3969 DATA 20,F0,FF,84,C9,86,CA,18,1220
3977 DATA 98,65,02,A0,A2,16,20,F0,879
3985 DATA FF,A9,00,85,CC,20,42,F1,1100
3993 DATA F0,FB,C9,8D,D0,06,20,02,1081
4001 DATA 10,4C,96,0F,C9,0D,F0,3E,773
4009 DATA C9,8D,F0,E9,C9,94,F0,E5,1633
4017 DATA C9,83,F0,E1,C9,14,D0,11,1243
4025 DATA A6,02,F0,D9,A9,20,CA,86,1162
4033 DATA 02,9D,00,02,A9,14,4C,D5,639
4041 DATA 0F,A6,02,E4,97,F0,C6,9D,1157
4049 DATA 00,02,E6,02,85,CC,85,D4,916
4057 DATA A2,00,86,CF,20,5F,10,A9,815
4065 DATA 00,86,CC,4C,96,0F,20,52,693
4073 DATA 10,C0,00,84,B7,A2,00,86,819
4081 DATA CF,86,D4,E8,86,CC,A9,20,1324
4089 DATA 20,5F,10,A9,0D,20,16,E7,610
4097 DATA 60,20,52,08,A9,00,85,02,525
4105 DATA 38,20,F0,FF,C4,C9,F0,1E,1250
4113 DATA A9,00,85,D4,A9,9D,20,16,894
4121 DATA E7,A9,20,20,16,E7,20,16,771
4129 DATA E7,A9,9D,20,16,E7,20,16,896
4137 DATA E7,85,D4,4C,09,10,60,A0,933
4145 DATA 00,B9,00,02,C9,0D,D0,02,611
4153 DATA A9,3F,C9,8D,D0,02,A9,3F,1016
4161 DATA A2,01,86,D4,20,16,E7,C8,994
4169 DATA C4,B7,90,E5,A9,00,85,D4,1266
4177 DATA A0,A0,10,B9,FF,01,C9,20,946
4185 DATA D0,03,88,D0,F6,60,C9,14,1118
4193 DATA F0,03,4C,16,E7,A9,00,85,874
4201 DATA D4,A9,9D,20,16,E7,A9,20,1024
4209 DATA 20,16,E7,20,16,E7,A9,9D,896
4217 DATA 20,16,E7,4C,16,E7,48,8A,824
4225 DATA 20,34,11,20,52,11,BE,73,537
4233 DATA 12,20,D5,11,20,D2,11,E6,769
4241 DATA 8B,D0,02,E6,8C,A0,00,B1,1056
4249 DATA 8B,C9,8C,F0,07,CA,D0,EF,1424
4257 DATA 68,A9,00,60,A9,00,85,14,691
4265 DATA 60,C5,14,F0,0B,E6,14,40,894
4273 DATA 20,08,11,68,B0,F3,C6,14,798
4281 DATA 20,8D,10,60,A0,00,A9,3C,722
4289 DATA 91,8B,A0,5A,A2,00,48,68,872
4297 DATA CA,D0,FD,20,E4,FF,D0,0C,1396
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(listing continued on next page)

Transdisc

(continued from previous page)

option is more useful on data files or source code from assemblers, etc.

If the file in memory is not a program file then the start address is set to zero and the end address is actually the number of bytes in the file. To find the number of bytes in a program file, subtract the displayed start address from the end address.

Use the Directory option to display the disc contents to the screen. If you ask for a match, enter the match when prompted and use wild cards — stars and question marks — where appropriate. See your disc drive manual for more information on wild cards.

When the directory display has finished, type any key to return to the main menu.

The Disc Status allows you to inspect the disc drive status when you are at the menu. The disc status is displayed on the bottom display box.

Disc CMDS allows you to send disc commands to the disc drive to do "house-keeping" jobs, such as deleting unwanted files and for validating and formatting discs. A conformation sub-menu is provided to help prevent accidental formatting of your favourite disc containing your best programs!

Sometimes, the disc drive can get confused. If at any point you feel the disc drive is not behaving correctly, issue a U; disc command which will reset the drive. For example, continual Drive not Ready messages can sometimes occur after failing to put a disk in the drive when saving a file on the first attempt.

Reset 64 resets the computer — performs a cold start. Note — the file in memory and the program are both lost after execution.

To get a copy of this program on disc, type in the program listed and save it. Now place a disc in the disc drive to receive the executable copy of this program and type run. If all is well, then the program will have saved an executable copy of the program on disc. If not, then the reported errors in the Data statements must be corrected and the listing re-saved ready for another attempt.

The program may be reloaded and executed when required by typing:

LOAD "TRANSDISK V2.0",8

This program has not been designed to transfer a large quantity of files from one disc to another — better to use a program specifically designed for batch copying. It does come into its own, however, when you wish to copy a file, but also to change or inspect all of the file parameters in the process.

Text is not destroyed

It should be noted that all of the individual functions selected from the menus do not affect the file loaded in memory, i.e., using directories, disc functions etc.

Even if the disc drive produces an error when attempting to save a program, the text in memory is not destroyed. In fact, once in memory the program can be saved as many times as required on different discs. ●

(continued from previous page)

```
4337 DATA C8,E6,14,4C,BD,10.C9,91,1080
4345 DATA D0,C2,20,23,11,90,BD,C6,1017
4353 DATA 14,4C,BD,10,A5,14,60,A0,742
4361 DATA 50,98,18,65,88,A9,00,65,766
4305 DATA 88,D0,F3,81,88,49,80,91,1249
4313 DATA 88,4C,C3,10,48,A0,00,A9,827
4321 DATA BC,91,88,68,C9,0D,F0,1C,1058
4329 DATA C9,11,D0,0A,20,08,11,90,637
4369 DATA 8C,C9,08,18,F0,0B,81,88,940
4377 DATA 18,C9,BC,D0,04,20,D2,11,884
4385 DATA 38,60,20,EB,11,A0,00,81,773
4393 DATA 88,C9,BC,38,F0,04,20,D2,1070
4401 DATA 11,18,60,48,20,52,11,B9,525
4409 DATA 78,12,BE,79,12,85,14,86,754
4417 DATA 15,B9,72,12,8D,86,02,B9,800
4425 DATA 73,12,85,8F,20,76,11,68,680
4433 DATA 60,20,6F,11,18,A9,00,79,570
4441 DATA 74,12,85,88,A9,04,69,00,684
4449 DATA 85,8C,BE,75,12,F0,06,20,876
4457 DATA D5,11,CA,D0,F8,60,48,0A,1066
4465 DATA 0A,0A,A8,68,60,A5,88,85,825
4473 DATA 8D,A5,8C,29,03,09,D8,85,848
4481 DATA 8E,A0,00,A9,A0,20,15,12,702
4489 DATA C4,8F,90,F9,20,D5,11,20,1026
4497 DATA 9F,11,D0,FB,A0,01,A9,00,965
4505 DATA 8D,86,02,4C,F9,11,A0,00,779
4513 DATA A9,A0,20,15,12,20,15,12,471
4521 DATA A2,00,A1,14,E6,14,D0,02,803
4529 DATA E6,15,C9,00,F0,0A,C9,0D,916
4537 DATA F0,06,20,15,12,4C,A9,11,579
4545 DATA 48,20,F9,11,20,D5,11,A0,792
4553 DATA 00,20,F9,11,20,D5,11,68,664
4561 DATA 60,20,D5,11,18,A5,88,69,791
4569 DATA 28,85,88,85,8D,A5,8C,69,996
4577 DATA 00,85,8C,29,03,09,D8,85,675
4585 DATA 8E,60,38,A5,88,E9,50,85,1044
4593 DATA 88,A5,8C,E9,00,85,8C,60,1046
4601 DATA A9,A0,20,15,12,C4,8F,90,883
4609 DATA F7,AD,86,02,48,A9,00,8D,938
4617 DATA 86,02,A9,A0,20,15,12,68,640
4625 DATA 8D,86,02,60,AA,98,18,65,820
4633 DATA 88,A9,00,65,8C,C9,08,B0,934
4641 DATA 0D,8A,29,3F,49,80,91,88,740
4649 DATA AD,86,02,91,8D,8A,C8,60,1029
4657 DATA 48,A9,0F,8D,18,D4,A9,0F,817
4665 DATA 8D,05,D4,A9,81,8D,06,D4,1015
4673 DATA 68,60,48,8A,48,A9,11,8D,809
4681 DATA 04,D4,A9,30,A2,75,8D,00,853
4689 DATA D4,8E,01,D4,20,69,12,A9,891
4697 DATA 10,8D,04,D4,20,69,12,A9,697
4705 DATA 00,8D,01,D4,68,AA,68,60,828
4713 DATA A2,00,20,B3,EE,CA,D0,FA,1271
4721 DATA 60,05,12,01,02,00,00,12,140
4729 DATA 13,06,13,0A,00,00,00,8A,192
4737 DATA 13,08,16,10,04,00,00,CA,271
4745 DATA 13,0E,13,0D,08,00,00,29,114
4753 DATA 14,04,0D,17,0A,00,00,69,175
4761 DATA 14,02,13,11,01,00,00,91,204
4769 DATA 14,06,25,01,15,00,00,DC,305
4777 DATA 14,0C,25,01,15,00,00,ED,328
4785 DATA 14,0E,25,01,15,00,00,F9,342
4793 DATA 14,08,25,01,15,00,00,18,114
4801 DATA 15,06,25,01,15,00,00,34,138
4809 DATA 15,0E,0D,02,04,00,00,41,119
4817 DATA 15,0C,25,01,15,00,00,7D,217
4825 DATA 15,04,25,01,15,00,00,8E,226
4833 DATA 15,02,25,01,15,00,00,97,233
4841 DATA 15,0C,25,01,15,00,00,B9,277
4849 DATA 15,0C,25,01,15,00,00,D3,303
4857 DATA 15,0C,25,01,15,00,00,EF,331
4865 DATA 15,02,25,01,15,00,00,0D,95
4873 DATA 16,02,25,01,15,00,00,2E,129
4881 DATA 16,4D,41,49,4E,20,53,45,499
4889 DATA 4C,45,43,54,49,4F,4E,0D,539
4897 DATA 4C,4F,41,44,20,46,49,4C,539
4905 DATA 45,2E,2E,2E,20,3C,0D,53,395
4913 DATA 41,56,45,20,46,49,4C,45,540
4921 DATA 2E,2E,2E,20,3C,0D,43,48,382
4929 DATA 41,4E,47,45,20,46,49,4C,534
4937 DATA 45,2E,20,3C,0D,44,49,52,443
4945 DATA 45,43,54,4F,52,59,2E,2E,562
4953 DATA 2E,20,3C,0D,44,49,53,48,450
4961 DATA 20,53,54,41,54,55,53,2E,562
4969 DATA 20,3C,0D,44,49,53,48,20,436
4977 DATA 43,4D,44,53,2E,2E,2E,20,465
4985 DATA 3C,0D,52,45,53,45,54,20,492
4993 DATA 43,36,34,2E,2E,2E,20,3C,403
5369 DATA 54,52,41,4E,53,44,49,53,616
5377 DATA 48,20,56,32,2E,30,20,20,401
5385 DATA 20,20,20,20,20,20,47,2E,309
5393 DATA 48,41,54,54,4F,20,27,38,511
5401 DATA 35,00,45,4E,54,45,52,20,467
5409 DATA 4E,45,57,20,53,54,41,52,580
5417 DATA 54,20,41,44,44,52,45,53,551
5425 DATA 53,3A,00,45,4E,54,45,52,523
5433 DATA 20,4D,41,54,43,48,3A,00,455
5441 DATA 53,54,41,52,54,53,20,41,578
5449 DATA 54,0D,2E,2E,2E,2E,2E,2E,373
5457 DATA 2E,2E,2E,0D,45,4E,44,53,449
5465 DATA 20,41,54,20,20,0D,2E,2E,350
5473 DATA 2E,2E,2E,2E,2E,2E,2E,0D,335
5481 DATA 46,49,4C,45,20,54,59,50,573
5489 DATA 45,0D,2E,2E,2E,2E,2E,2E,358
5497 DATA 2E,2E,2E,00,43,55,52,52,454
5505 DATA 45,4E,54,20,46,49,4C,45,551
5513 DATA 20,49,53,3A,00,54,4F,54,493
5521 DATA 41,4C,20,4F,46,00,4C,4F,477
5529 DATA 41,44,20,45,52,52,4F,52,559
5537 DATA 3A,20,2A,2A,2A,20,4F,55,412
5545 DATA 54,20,4F,46,20,4D,45,4D,520
5553 DATA 4F,52,59,20,2A,2A,2A,00,408
5561 DATA 4C,4F,41,44,49,4E,47,20,542
5569 DATA 53,45,4C,45,43,54,45,44,585
5577 DATA 20,46,49,4C,45,2E,2E,2E,458
5585 DATA 2E,00,53,41,56,49,4E,47,502
5593 DATA 20,4E,45,57,20,46,49,4C,517
5601 DATA 45,20,4F,4E,20,44,49,53,514
5609 DATA 4B,2E,2E,2E,2E,00,45,52,410
5617 DATA 41,53,49,4E,47,20,45,58,559
5625 DATA 49,53,54,49,4E,47,20,46,564
5633 DATA 49,4C,45,20,4F,4E,20,44,507
5641 DATA 49,53,4B,00,41,52,45,20,479
5649 DATA 59,4F,55,20,53,55,52,45,604
5657 DATA 3F,20,20,2D,20,54,59,50,457
5665 DATA 45,20,27,59,27,20,4F,52,461
5673 DATA 20,27,4E,27,00,22,20,22,288
5681 DATA 20,4E,4F,54,20,41,4C,4C,522
5689 DATA 4F,57,45,44,20,49,4E,20,518
5697 DATA 46,49,4C,45,4E,41,4D,45,577
5705 DATA 00,00,00,00,00,00,00,00,0-
5001 DATA 00,53,41,56,45,20,20,53,450
5009 DATA 45,4C,45,43,54,49,4F,4E,595
5017 DATA 0D,43,52,45,41,54,45,20,481
5025 DATA 46,49,4C,45,2E,2E,20,3C,472
5033 DATA 0D,52,45,50,4C,41,43,45,521
5041 DATA 20,46,49,4C,45,2E,20,3C,458
5049 DATA 0D,4D,41,49,4E,20,4D,45,484
5057 DATA 4E,55,2E,2E,2E,2E,20,3C,439
5065 DATA 00,43,48,41,4E,47,45,20,454
5073 DATA 46,49,4C,45,20,50,41,52,547
5081 DATA 41,4D,53,0D,46,49,4C,45,526
5089 DATA 20,4E,41,4D,45,2E,2E,2E,459
5097 DATA 2E,2E,2E,2E,20,3C,0D,46,359
5105 DATA 49,4C,45,20,54,59,50,45,572
5113 DATA 2E,2E,2E,2E,2E,2E,2E,20,354
5121 DATA 3C,0D,53,54,41,52,54,20,503
5129 DATA 41,44,44,52,45,53,53,2E,564
5137 DATA 2E,2E,20,3C,0D,4D,41,49,412
5145 DATA 4E,20,4D,45,4E,55,2E,2E,511
5153 DATA 2E,2E,2E,2E,2E,20,3C,00,322
5161 DATA 44,49,53,48,20,44,49,52,554
5169 DATA 45,43,54,4F,52,59,2E,0D,529
5177 DATA 4E,4F,20,4D,41,54,43,48,554
5185 DATA 2E,2E,2E,2E,2E,20,3C,0D,335
5193 DATA 53,45,4C,45,43,54,20,4D,557
5201 DATA 41,54,43,48,2E,20,3C,0D,439
5209 DATA 4D,41,49,4E,20,4D,45,4E,549
5217 DATA 55,2E,2E,2E,2E,20,3C,00,361
5225 DATA 46,49,4C,45,20,54,59,50,573
5233 DATA 45,0D,53,45,51,2E,2E,2E,453
5241 DATA 2E,20,3C,0D,50,52,47,2E,430
5249 DATA 2E,2E,2E,20,3C,0D,55,53,411
5257 DATA 52,2E,2E,2E,2E,20,3C,00,358
5265 DATA 4C,4F,41,44,20,53,45,4C,548
5273 DATA 45,43,54,49,4F,4E,0D,53,546
5281 DATA 45,51,20,46,49,4C,45,2E,516
5289 DATA 2E,2E,2E,20,3C,0D,50,52,405
5297 DATA 47,20,46,49,4C,45,2E,2E,483
5305 DATA 2E,2E,20,3C,0D,55,53,52,447
5313 DATA 20,46,49,4C,45,2E,2E,2E,458
5321 DATA 2E,20,3C,0D,4D,41,49,4E,444
5329 DATA 20,4D,45,4E,55,2E,2E,2E,479
5337 DATA 20,3C,00,45,4E,54,45,52,474
5345 DATA 20,46,49,4C,45,20,4E,41,495
5353 DATA 4D,45,3A,00,57,4F,52,48,527
5361 DATA 49,4E,47,2E,2E,2E,2E,00,406
```

Locomotion

This is a game written for the BBC and Electron which features full screen scrolling, animated multi-coloured graphics and original music. The game itself is written in two parts which have to be typed, checked, and saved and then run. The first program contains all the machine-code routines while the second sets up the screen, checks the number of lives left, plays the music and controls most of the aspects of the game which do not require the speed of machine code.

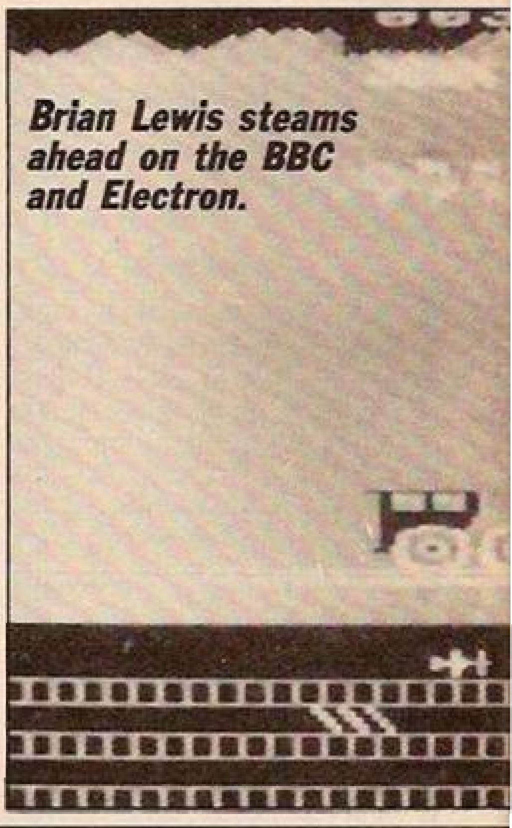
Locomotion has you in control of a runaway steam locomotive. You are unable to stop or slow down this train. However, you may change tracks. You must also watch out for attacks by planes, airships and C5s. To shoot these enemies you have the following weapons — smoke and harpoons. However, the eccentricities of these must be learnt if they are to be used to destroy the C5s; to fire simply press the space bar. There is a counter on the firing mechanism so once it has been fired it takes a long time before the harpoon is ready to fire again, so an early shot will prove fatal for you.

Now we come to the more complex smoke firing routine. To fire the smoke simply press the Return key. The longer you hold down this key after the smoke is launched the higher it goes until it flies over to the left of the screen after you release the Return key. There can be up to three pieces of smoke in the air at one time but, once these three have been fired, you cannot fire again until the last one out of those three has left the screen.

To scroll the whole screen on the Electron would take too long for a playable game to be written around it, so instead of making a window and scrolling just a small but concentrated box, as in Jump Jet Assault, I simply scrolled small sections of the screen, such as the track and radar the full length of the screen thus giving a more pleasing overall effect.

The short musical sequences are original and previously composed on a Roland keyboard. If BBC users wish to type in the program they must once again increase the contents of the x and y registers in line 400 of listing 1, the particular values will have to be found through experiment.

Brian Lewis steams ahead on the BBC and Electron.

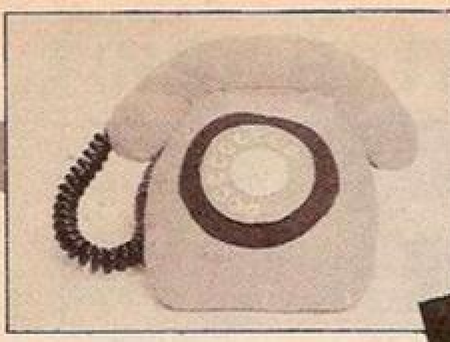


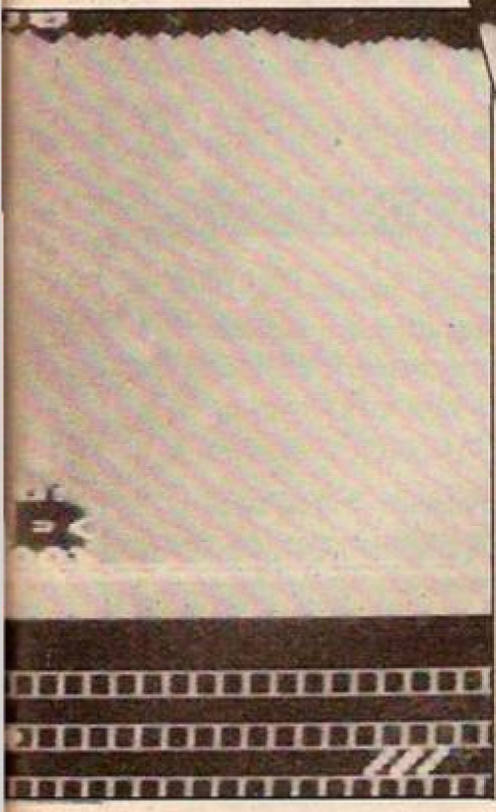
Listing 1.

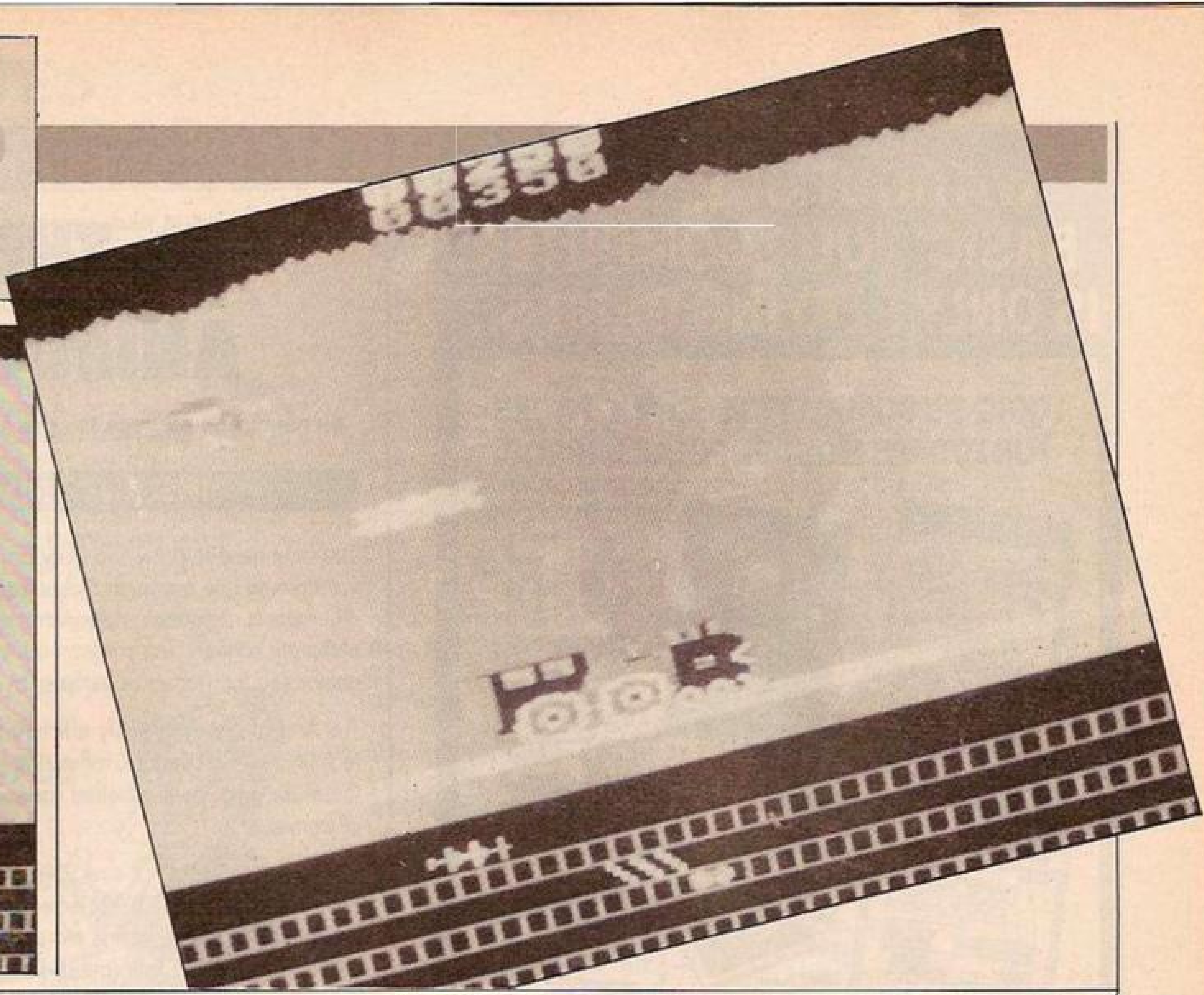
```
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40,128,128,128,128,128,135,135,135,0,0,0,0,0,15,30,15,
0,0,0,0,0,15,225,30,3,1,1,1,1,60,60,60,15,30,150,150,3
0,240,240,240,132,8,8,8,8,224
   30DATA240,240,0,0,0,0,0,0,0,0,128,0,0,0,0,0,0,0,0,48,
48,48,48,48,48,48,48,240,240,240,240,243,199,199,199,2
40,240,240,255,15,15,15,111,240,240,240,225,207,47,47,
47,15,15,15,15,31,47,47,47,15,15,15,127,143,15,15,63,1
5,15,15,143,111,31,31,31,60
   40DATA60,60,60,60,60,60,60,240,240,240,128,224,128,
240,240,240,240,240,240,241,241,240,240,128,192,196,20
0,134,134,200,196,0,0,0,0,0,0,0,0,0,48,112,112,0,0,0,0,0
,199,143,71,71,71,71,51,0,249,249,249,111,15,15,15,255
,47,31,46,46,46,46,204,0,47
   50DATA79,35,35,35,35,17,0,124,124,124,63,15,15,143,
119,159,143,159,31,31,31,110,136,60,188,112,115,199,71
,71,51,240,240,240,241,235,235,171,17,240,240,240,249,
124,124,76,136,192,128,128,0,136,204,102,0,0,0,0,0,0,0
,0,0
   60DATA102,255,119,51,119,255,255,51,102,255,238,238
,238,255,255,34
   70DATA&10,0,1,0,5,0,2,0,0,0,0,8,4,48,4,0,0,0,0,0,0,34,2
43,34,0,0,&11,0,2,0,150,0,5,0,15,100,34,35,35,34,100,1
5,15,100,116,54,54,116,100,15
   80DATA240,128,16,16,16,16,128,240,240,16,128,0,128,
0,16,240,240,240,242,243,242,240,240,240,244,244,244,2
54,244,244,244,240
   90DATA0,8,12,12,14,15,15,15,16,112,112,0,0,30,30,15
,240,240,240,0,255,255,241,60,0,128,128,0,0,132,164,16
4,15,7,3,0,17,0,0,0,15,15,15,136,0,0,0,0,0,15,15,15,34,1
7,35,18,1,60,44,44,0,0,136,8,0
  100DATA240,243,247,255,255,247,243,240,240,252,254,2
55,255,254,252,240
  110DATA0,0,0,17,51,119,119,255,0,119,255,255,243,101
,101,243,0,238,255,255,251,251,251,251,0,0,0,136,204,2
38,238,255,119,119,51,17,0,0,0,0,101,101,243,255,255,1
12,83,112,251,251,240,255,255,224,108,224,238,238,204,
136,0,0,0,0
  120DATA&10,0,3,0,0,0,10,0,136,204,51,119,71,119,35,1
7,17,51,204,238,46,238,76,136
  130DATA15,100,100,100,100,100,100,15,15,100,100,100,
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5,35,35,255,144,15
  140DATA0,0,0,0,17,17,34,34,0,0,0,136,0,0,0,0,0,0,0,0
,0,0,17,51,0,0,0,68,68,68,68,238,255,68,68,204,255,115,0
3,83,32,0,0,0,255,215,215,195,0,118,117,117,253,253,25
3,169,16,243,125,237,253,253,108,172,192
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  160BT%=Q%+8::sm%=BT%+288:mo%=sm%+16:ar%=mo%+8:hi%=ar
%+16:tr%=hi%+8:pl%=hi%+48:bp%=pl%+16:as%=bp%-64:ba%=as
%+16:ex%=ba%+64:bo%=ex%+8:TB%=bo%+16:Cl11=TB%+16:CLI2=
Cl11+16:H%=CLI2+64:FORT=0TO647:READD:T?BT%=D:NEXT
  170FORT=0TO2STEP2:P%=H%:[OPTT
  180SEC:LDA&CB:SBC#5:STA&CB:JSRscore
  190LDA#&FF:STA&94F:LDA#0:STA&A0:STA&7B:STA&90:STA&C5
0:STA&C51:STA&C53:STA&C55:STA&C56:STA&94E:STA&95:LDA#&
C0:STA&96:LDA#&60:STA&97:LDA#1:STA&C54:LDA#30:STA&C52:
LDA#&A0:STA&80:LDA#&7B:STA&81:LDA#&40:STA&91:LDA#&77:S
TA&92:LDA#&70:STA&A1
  200LDA#0:STA&6C:STA&A4:STA&8E:STA&8F:LDA#&30:STA&65:
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:LDA&72D0:STA&D52:TXA:STA&72D0:LDA&72D8:STA&D53:TXA:ST
A&72D8
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  220JSRani
  230LDA#&80:STA&70:LDA#&73:STA&71:JSRscroll:INC&74:LD
A&74:CMP#2:BNEe:LDA#0:STA&74:LDA#&C0:STA&70:LDA#&5B:ST
A&71:JSRscroll:LDA#&C0:STA&70:LDA#&79:STA&71:LDX#&FF:J
SRscroll:LDA#&40:STA&70:LDA#&7C:STA&71
  240LDX#&FF:JSRscroll
  250.e LDY&94F:CPY#&FF:BEQe1:LDA&95C,Y:AND#2:BNEf1:.e
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A&95C,Y:AND#1:CMP#1:BNEh:JSRmfire:.h INY:CPY#3:BNEg:.f
  260LDA&94A:BEQCc1:CLC:LDA&96:ADC#&20:STA&4D:LDA&97:A
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CPY#24:BNEAa1:LDY#32:.Bb1 LDA(&4D),Y:EORbp%,Y:BNEhit:I
NY:CPY#56:BNEBb1:JMPCc1:.hit JSRHITPL:.Cc1
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:CPY#32:BNEDd1:.Ee1 LDA(&4D),Y:EORba%,Y:BNEhit2:INY:CP
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DX#&9D:JSRkey:CPY#&FF:BNEi:JSRfire2:LDA#0:STA&94E:.i L
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  290LDA&6C:BEQHhH3:CLC:LDA&56:ADC#&20:STA&4D:LDA&57:A
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INY:CPY#64:BNEHhH1:JMPHhH3:.HiiT JSRHiSI:.HhH3
  300JSRtrack:LDX#&BE:JSRkey:CPY#&FF:BNEk:JSRup:.k LDX
#&9E:JSRkey:CPY#&FF:BNEl:JSRdown:.l
  310LDA#0:STA&94B:LDA&B0:BEQxX2:JSRBoM:CPX#&FF:BNExX2
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xxX3
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A&6B:CMP&6A:BNECcC2:LDA&64:CMP#135:BNECcC2:RTS:.CcC2
  340INC&90:LDA&90:CMP#120:BMIm2:CMP#198:BPLm2:JSRplan
e1:.m2 INC&A0:LDA&A0:CMP#84:BMIM33:CMP#204:BPLM33:JSRa
irship:.M33 INC&64:LDA&64:CMP#120:BMIm4m:CMP#158:BPLm4
m:JSRclive1:.m4m LDA&64:CMP#159:BNEm5m:LDA#200:STA&64:
.m5m JSRdelay:JMPstart
  350.scroll CLC:LDA&70:ADC#8:STA&72:LDA&71:ADC#0:STA&
73
  360STX&4F:CPX#&FF:BEQtyu:CLC:LDA&70:ADC#&38:STA&75:L
DA&71:ADC#1:STA&76:LDY#0:.a LDA(&70),Y:STAQ%,Y:INY:CPY
#8:BNEa:.tyu
  370LDX#0:.b LDY#0:.c LDA(&72),Y:STA(&70),Y:INY:CPY#8
:BNEc
  380CLC:LDA&72:ADC#8:STA&72:LDA&73:ADC#0:STA&73:CLC:L
DA&70:ADC#8:STA&70:LDA&71:ADC#0:STA&71:INX:CPX#39:BNEb
  390LDX&4F:CPX#&FF:BEQTYU:LDY#0:.d LDAQ%,Y:STA(&75),Y
:INY:CPY#8:BNEd:.TYU
  400RTS
  410.delay LDX#40:.A LDY#100:.B DEY:BNEB:DEX:BNEA:RTS
:.key LDY#&FF:LDA#&81:JMP&FFF4
  420.FIRE INC&94F:LDY&94F:CPY#4:BEQD1:LDA&95C,Y:CMP#0
:BNED:LDY#0:.C LDAsm%,Y:STA&6F28,Y:INY:CPY#16:BNEC:LDY
&94F:LDA#&28:STA&950,Y:LDA#&6F:STA&953,Y:LDA#0:STA&956
,Y:STA&959,Y
  430LDA#3:STA&95C,Y:LDA#7:LDX#so% MOD256:LDY#so% DIV2
56:JSR&FFF1
  440RTS:.D1 LDA#&FF:STA&94F:.D RTS
  450.mfire STY&960:LDA&950,Y:STA&4D:LDA&953,Y:STA&4E:
LDY#0:TYA:.E STA(&4D),Y:INY:CPY#16:BNEE
  460LDA&960:CMP&94F:BNEF12:LDX#&B6:JSRkey:CPY#&FF:BNE
F12:LDY&960:LDA&959,Y:TAX:INX:CPX#15:BEQF12:TXA:STA&95
9,Y:SEC:LDA&4D:SBC#&40:STA&4D:LDA&4E:SBC#1:STA&4E
  470.F11 JMPF13:.F12 LDY&960:LDA#1:STA&95C,Y:LDA&956,
Y:TAX:INX:CPX#20:BEQF14:TXA:STA&956,Y:LDA&950,Y:STA&4D
:LDA&953,Y:SEC:LDA&4D:SBC#8:STA&4D:LDA&4E:SBC#0:STA&4E
  480.F13 LDY#0:.F15 LDAsm%,Y:STA(&4D),Y:INY:CPY#16:BN
EF15:LDY&960:LDA&4D:STA&950,Y:LDA&4E:STA&953,Y:RTS:.F1
4 LDY&960:CPY#2:BNEe11:LDA#&FF:STA&94F:.e11 LDA#0:STA&
95C,Y
  490RTS:LDY&960:LDA&4D:STA&950,Y:LDA&4E:STA&953,Y:RTS
  500.fire2 LDA#7:LDX#hi% MOD256:LDY#hi% DIV256:JSR&FF
F1:LDA#0:STA&78:LDA#&73:STA&79:LDA#0:STA&7A:LDA#1:STA&
7B:.bulpr LDY#0:.K LDAar%,Y:STA(&78),Y:INY:CPY#16:BNEK
:RTS
  510.mFIRE2 LDY#0:TYA:.L STA(&78),Y:INY:CPY#16:BNEL:I
NC&7A:LDA&7A:CMP#13:BEQM:CLC:LDA&78:ADC#8:STA&78:LDA&7
9:ADC#0:STA&79:JMPbulpr:.M LDA#0:STA&7B:RTS
```

Listing 2.

```
   20Mus1=510:Dat1=13
   30MODE4:PRINTTAB(10,3);"Instructions (Y/N) ?"
   40A$=GET$:IF A$<>"Y" AND A$<>"N" THEN40
   50IF A$="Y" THEN PROCinstructions
   60HS$="00200"
   70VDU23,128,255,68,68,68,68,68,68,255,23,129,17,17,
34,34,68,68,136,136,23,130,136,136,68,68,34,34,17,17
   80ENVELOPE1,1,2,1,0,0,5,0,126,0,0,-126,126,126
   90ENVELOPE2,3,-1,-1,3,0,1,10,126,0,0,-126,126,126
  100ENVELOPE3,1,1,2,-2,1,3,2,126,0,0,-126,126,126
  110ENVELOPE5,2,1,-1,1,4,3,1,126,0,0,-126,126,126
  120DATA255,248,255,255,0,0,0,0,255,240,255,239,1,1,3
,3,255,240,255,255,0,0,8,8,255,240,255,255,0,0,0,0
  130MODE5:FORT=0TO4:T?&CA=0:NEXT:PROCsetup:COLOUR3:PR
INTTAB(3,27);"Space To Start";TAB(3,29);"Space To Star
t":T%=0
  140CALLI%:PROCkey
  150FORlives%=3 TO 1 STEP-1
  160IF lives%<>3 THEN PROCsetup
  170COLOUR130:COLOUR0:PRINTTAB(9,0);lives%:COLOUR1:PR
INTTAB(7,2);HS$;
  180CALLH%:PROCdead:NEXT
  181COLOUR128
  190VDU26:A$="GAME  OVER":FORT%=1TOLENA$:PRINTTAB(4+
%,17);MID$(A$,T%,1);:SOUND&11,5,100-(T%*2),2:FORG=0T
50:NEXT,
  200FORG=0TO3000:NEXT
  210A$="":FORT=4TO0 STEP-1:A$=A$+STR$(T?&CA):NEXT:I
VAL(A$)>VAL(HS$) THEN HS$=A$
  220GOTO130
  230DEFPROCsetup:VDU19,0,2;0;19,2,0;0;17,128,12,23;
02;0;0;0;
  240FORT%=0TO2:T%?&95C=0:NEXT:FORT%=0TO9:RESTORE120
  250FORG%=0TO31:READD:G%?(&7380+(T%*32))=D:NEXT,
  260VDU28,0,31,19,24,17,130,12,26
  270GCOL0,2:X%=896:FORT%=0TO1279STEP8:MOVET%,1023:D
WT%,X%:G%=RND(4):IF G%>2 AND X%<928 X%=X%+4 ELSE IF 
>896 X%=X%-4
  280NEXT
  290COLOUR1:PRINTTAB(0,26);STRING$(20,CHR$128);TAB(
28);STRING$(20,CHR$128);TAB(0,30);STRING$(20,CHR$128
  300VDU30,23;8202;0;0;0;:ENDPROC
  310DEFPROCdead
```







```
  52Ø.track INC&C5Ø:LDA&C5Ø:CMP&C52:BNEN:CLC:LDA&C52:A
DC#5:STA&C52:CMP#7Ø:BNEBOT:LDA#3Ø:STA&C52:.BOT
  53ØLDA#Ø:STA&C5Ø:LDA&C51:EOR#&FF:STA&C51:BEQbot:LDA&
C53:INC&C55:LDX&C55:CPX#2:BNER:EOR#1:STA&C53:LDX#Ø:STX
&C55:.R CLC:ADC#129:TAY:LDX#27:JMPpri:.bot LDA&C54:INC
&C56:LDX&C56:CPX#2:BNES:EOR#1:STA&C54:LDX#Ø:STA&C56:.S
 CLC:ADC#129:TAY:LDX#29
  54Ø.pri LDA#17:JSR&FFEE:LDA#3:JSR&FFEE:LDA#31:JSR&FF
EE:LDA#18:JSR&FFEE:TXA:JSR&FFEE:TYA:JMP&FFEE
  55Ø.N RTS
  56Ø.trpri LDY#Ø:.O LDAtr%,Y:STA(&8Ø),Y:INY:CPY#16:BN
EO:RTS
  57Ø.up SEC:LDA&8Ø:SBC#&4Ø:STA&4D:LDA&81:SBC#1:STA&4E
:LDY#Ø:LDA(&4D),Y:CMP#241:BNEend:DEC&4A:JSRrub:SEC:LDA
&8Ø:SBC#&8Ø:STA&8Ø:LDA&81:SBC#2:STA&81:JMPtrpri:.end R
TS
  58Ø.down CLC:LDA&8Ø:ADC#&4Ø:STA&4D:LDA&81:ADC#1:STA&
4E:LDY#Ø:LDA(&4D),Y:CMP#24Ø:BNEend:INC&4A:JSRrub:CLC:L
DA&8Ø:ADC#&8Ø:STA&8Ø:LDA&81:ADC#2:STA&81:JMPtrpri:.end
 RTS
  59Ø.rub LDY#Ø:.Q LDATR%,Y:STA(&8Ø),Y:INY:CPY#16:BNEQ
:RTS
  6ØØ.T4 LDA#&4Ø:STA&91:LDA#&77:STA&92:.T3 RTS:.plane1
 INC&95:LDA&95:CMP#2:BNET3:LDA#Ø:STA&95:LDY#Ø:LDA#24Ø:
.T1 STA(&91),Y:INY:CPY#16:BNET1:LDA&9Ø:CMP#197:BEQT4:C
LC:LDA&91:ADC#8:STA&91:LDA&92:ADC#Ø:STA&92:LDA&9Ø
  61ØLDY#Ø:STY&94A:.T2 LDApl%,Y:STA(&91),Y:INY:CPY#16:
BNET2:LDA&9Ø:CMP#139:BMIT3:CMP#176:BPLT3:CLC:LDA&96:AD
C#&4Ø:STA&4D:LDA&97:ADC#1:STA&4E:LDY#Ø:TYA:.T5 STA(&96
),Y:STA(&4D),Y:INY:CPY#32:BNET5:LDA&9Ø:CMP#175:BEQT7
  62ØCLC:LDA&96:ADC#16:STA&96:LDA&97:ADC#Ø:STA&97:CLC:
LDA&96:ADC#&2Ø:STA&4D:LDA&97:ADC#1:STA&4E:LDY#Ø:.T6 LD
Abp%,Y:STA(&96),Y:INY:CPY#32:BNET6:.TT6 LDAbp%,Y:STA(&
4D),Y::INY:CPY#64:BNETT6:LDA#1:STA&94A
  63ØLDA&97:CMP#&61:BNETT7:LDA&96:CMP#&5Ø:BNETT7:JSRbo
mb:.TT7 RTS:.T7 LDA#&CØ:STA&96:LDA#&6Ø:STA&97
  64ØRTS:.U3 LDA#&7Ø:STA&A1:LDA#&78:STA&A2:RTS
  65Ø.airship INC&A5:LDA&A5:CMP#3:BNEU1:LDY#Ø:STY&A5:.
U2 LDA#24Ø:STA(&A1),Y:INY:CPY#16:BNEU2:LDA&AØ:CMP#2ØØ:
BPLU3:SEC:LDA&A1:SBC#8:STA&A1:LDA&A2:SBC#Ø:STA&A2:LDY#
Ø:.U4 LDAas%,Y:STA(&A1),Y:INY
  66ØCPY#16:BNEU4:.U1 LDA&AØ:CMP#1Ø4:BMIu1:CMP#176:BPL
u1:LDA&94C:EOR#1:STA&94C:BNEu1:CLC:LDA&A3:ADC#&4Ø:STA&
4D:LDA&A4:ADC#1:STA&4E:LDY#Ø:TYA:.u2 STA(&A3),Y:STA(&4
D),Y:INY:CPY#32:BNEu2:LDA&AØ:CMP#175:BEQu3
  67ØSEC:LDA&A3:SBC#8:STA&A3:LDA&A4:SBC#Ø:STA&A4:CLC:L
DA&A3:ADC#&2Ø:STA&4D:LDA&A4:ADC#1:STA&4E:LDA#1:STA&94B
:LDY#Ø:.u4 LDAba%,Y:STA(&A3),Y:INY:CPY#32:BNEu4:.uu4 L
DAba%,Y:STA(&4D),Y:INY:CPY#64:BNEuu4
  68ØLDA&A4:CMP#&5E:BNEu1:LDA&A3:CMP#&8Ø:BNEu1:JSRBOMB
2:.u1 RTS
  69Ø.u3 LDA#&6Ø:STA&A3:LDA#&5F:STA&A4:RTS
  7ØØ.HITPL JSR&XX:CLC:LDA&96:ADC#&4Ø:STA&4D:LDA&97:AD
C#1:STA&4E:LDY#Ø:.vV1 LDA(&96),Y:EOR(&4D),Y:ANDH%,Y:ST
A(&96),Y:LDA(&4D),Y:EORH%,Y:AND(&96),Y:STA(&4D),Y:INY:
CPY#32:BNEvV1:JSRdelay
  71ØJSRdelay:JSRdelay
  72ØLDY#Ø:STY&94A:LDA#24Ø:.vV3 STA(&91),Y:INY:CPY#16:
BNEvV3:LDA#&4Ø:STA&91:LDA#&77:STA&92:JSRdelay:CLC:LDA&
96:ADC#&4Ø:STA&4D:LDA&97:ADC#1:STA&4E:LDY#Ø
  73ØTYA:.vV2 STA(&96),Y:STA(&4D),Y:INY:CPY#32:BNEvV2:
LDA#&CØ:STA&96:LDA#&6Ø:STA&97:LDA#2Ø1:STA&9Ø:LDA#Ø:STA
&95:RTS
  74Ø.eXX JSRscore:LDA#7:LDX#ex% MOD256:LDY#ex% DIV256
:JMP&FFF1
  75Ø.HITAS JSR&XX:CLC:LDA&A3:ADC#&4Ø:STA&4D:LDA&A4:AD
C#1:STA&4E:LDY#Ø:.wW1 LDA(&A3),Y:EOR(&4D),Y:ANDQ%,Y:ST
A(&A3),Y:LDA(&4D),Y:EORQ%,Y:ORA(&A3),Y:STA(&4D),Y:INY:
CPY#32:BNEwW1:JSRdelay
  76ØJSRdelay:JSRdelay
  77ØLDY#Ø:STY&94B:LDA#24Ø:.wW3 STA(&A1),Y:INY:CPY#16:
BNEwW3:LDA#&7Ø:STA&A1:LDA#&78:STA&A2:JSRdelay:CLC:LDA&
A3:ADC#&4Ø:STA&4D:LDA&A4:ADC#1:STA&4E:LDY#Ø
  78ØTYA:.wW2 STA(&A3),Y:STA(&4D),Y:INY:CPY#32:BNEwW2:
LDA#&6Ø:STA&A3:LDA#&5F:STA&A4:LDA#2ØØ:STA&AØ:RTS
  79Ø.bomb LDA#1:STA&BØ:LDA#&DØ:STA&B1:LDA#&63:STA&B2:
.BOPRI LDY#Ø:.Xx1 LDAbo%,Y:STA(&B1),Y:INY:CPY#16:BNEXx
1:RTS
  8ØØ.BoM INC&B3:LDA&B3:CMP#3:BNEXx2:LDA#Ø:STA&B3:JSRb
Rub:CLC:LDA&B1:ADC#&4Ø:STA&B1:LDA&B2:ADC#1:STA&B2:JSRB
OPRI:LDA&B2:CMP#&7Ø:BNEXx2:LDA&B1:CMP#&5Ø:BNEXx2:LDA#Ø
:STA&BØ:LDX#&FF:RTS:.Xx2 LDX#Ø:RTS
  81Ø.bRub LDY#Ø:TYA:.xX1 STA(&B1),Y:INY:CPY#16:BNExX1
:RTS
  82Ø.BhI LDA#Ø:STA&BØ:JSR&XX:LDY#Ø:.xx1 LDA(&B1),Y:EO
RO%,Y:ANDH%,Y:STA(&B1),Y:INY:CPY#16:BNExx1:JSRdelay2:J
MPbRub
  83Ø.delay2 LDX#1ØØ:.aA LDY#1ØØ:.bB DEY:BNEbB:DEX:BNE
aA:RTS
  84Ø.BOMB2 LDA&BA:EOR#1:STA&BA:BNEZz1:LDA#1:STA&B6:LD
A#&38:STA&B7:LDA#&61:STA&B8:.bpri2 LDY#Ø:.Zz2 LDAbo%,Y
:STA(&B7),Y:INY:CPY#16:BNEZz2:.Zz1 RTS
  85Ø.bOm2 INC&B9:LDA&B9:CMP#4:BNEYy2:LDA#Ø:STA&B9:JSR
BrUB2::CLC:LDA&B7:ADC#&4Ø:STA&B7:LDA&B8:ADC#1:STA&B8:J
SRbpri2:LDA&B8:CMP#&7Ø:BNEYy2:LDA&B7:CMP#&38:BNEYy2:LD
A#Ø:STA&B6:LDX#&FF:RTS:.Yy2 LDX#Ø:RTS
  86Ø.BrUB2 LDY#Ø:TYA:.Yy3 STA(&B7),Y:INY:CPY#16:BNEYy
3:RTS
  87Ø.BhI2 LDA#Ø:STA&B6:JSR&XX:LDY#Ø:.XXx1 LDA(&B7),Y:
EORO%,Y:ANDH%,Y:STA(&B7),Y:INY:CPY#16:BNEXXx1:JSRdelay
2:JMPBrUB2
  88Ø.aAa5 CLC:LDA&65:ADC#&3Ø:STA&65:LDA&66:ADC#1:STA&
66:RTS:.clive1 LDY#Ø:JSRCRUB:SEC:LDA&65:SBC#8:STA&65:L
DA&66:SBC#Ø:STA&66:LDA&64:CMP#157:BEQaAa5:LDY#Ø:.aAa2
LDACli1,Y:STA(&65),Y:INY:CPY#16:BNEaAa2
  89ØLDA&6B:CMP&6A:BEQaAa3:LDA&6B:CMP&6A:BPLUup:BMIDdo
:.aAa3 RTS
  9ØØ.Uup SEC:LDA&65:SBC#&38:STA&4D:LDA&66:SBC#1:STA&4
E:LDY#Ø:LDA(&4D),Y:CMP#24Ø:BNEbBb1:JSRCRUB:SEC:LDA&65:
SBC#&8Ø:STA&65:LDA&66:SBC#2:STA&66:DEC&6B:.bBb1 RTS
  91Ø.Ddo CLC:LDA&65:ADC#&48:STA&4D:LDA&66:ADC#1:STA&4
E:LDY#Ø:LDA(&4D),Y:CMP#241:BNEbBb2:JSRCRUB:CLC:LDA&65:
ADC#&8Ø:STA&65:LDA&66:ADC#2:STA&66:INC&6B:.bBb2 RTS
  92Ø.CRUB LDY#Ø:.aAa1 LDATR%,Y:STA(&65),Y:INY:CPY#16:
BNEaAa1:RTS
  93Ø.CLLI SEC:LDA&64:SBC#13Ø:TAX:LDA#Ø:STA&EE:STA&EF:
.EeE1 CPX#Ø:BEQEeE2:CLC:LDA&EE:ADC#16:STA&EE:LDA&EF:AD
C#Ø:STA&EF:DEX:JMPEeE1:.EeE2 SEC:LDA#&1Ø:SBC&EE:STA&F2
:STA&56:LDA#&72:SBC&EF:STA&F3:STA&57
  94ØCLC:LDA&F2:ADC#32:STA&6Ø:LDA&F3:ADC#Ø:STA&61:CLC:
LDA&6Ø:ADC#&4Ø:STA&62:LDA&61:ADC#1:STA&63:LDY#Ø:.EeEE3
 LDA#Ø:STA(&6Ø),Y:STA(&62),Y:INY:CPY#16:BNEEeEE3
  95ØLDY#Ø:.EeE3 LDACLI2,Y:STA(&F2),Y:INY:CPY#32:BNEEe
E3:CLC:LDA&F2:ADC#&2Ø:STA&FØ:LDA&F3:ADC#1:STA&F1:.EeE5
 LDACLI2,Y:STA(&FØ),Y:INY:CPY#64:BNEEeE5:RTS
  96Ø.HiSI JSR&XX:JSRdelay:JSRdelay:JSRCRUB:CLC:LDA&56
:ADC#&4Ø:STA&4D:LDA&57:ADC#1:STA&4E:LDY#Ø:TYA:.Iii1 ST
A(&56),Y:STA(&4D),Y:INY:CPY#32:BNEIii1:LDA#Ø:STA&6C:ST
A&64:LDA#&3Ø:STA&65:LDA#&7C:STA&66:LDA#2:STA&6B:RTS
  97Ø.score CLC:LDA&CB:ADC#5:STA&CB:CMP#1Ø:BNEshow:LDA
#Ø:STA&CB:INC&CC:LDA&CC:CMP#1Ø:BNEshow:LDA#Ø:STA&CC:IN
C&CD:LDA&CD:CMP#1Ø:BNEshow:LDA#Ø:STA&CD:INC&CE
  98Ø.show LDA#31:JSR&FFEE:LDA#7:JSR&FFEE:LDA#1:JSR&FF
EE:LDA#17:JSR&FFEE:LDA#3:JSR&FFEE:LDY#4:.KkK1 CLC:LDA&
CA,Y:ADC#48:JSR&FFEE:DEY:CPY#&FF:BNEKkK1:RTS
  99Ø.I% LDA#&3Ø:STA&7Ø:LDA#&7Ø:STA&71:CLC:LDA&7Ø:ADC#
224:STA&72:LDA&71:ADC#Ø:STA&73:LDA&72:ADC#224:STA&74:L
DA&73:ADC#Ø:STA&75
 1ØØØLDY#Ø:.ti1 LDABT%,Y:STA(&7Ø),Y:INY:CPY#96:BNEti1:
.ti2 LDABT%,Y:STA(&72),Y:INY:CPY#192:BNEti2:.ti3 LDABT
%,Y:STA(&74),Y:INY:CPY#Ø:BNEti3
 1Ø1ØCLC:LDA&74:ADC#Ø:STA&74:LDA&75:ADC#1:STA&75:LDY#Ø
:.ti4 LDABT%+256,Y:STA(&74),Y:INY:CPY#32:BNEti4:RTS
 1Ø2Ø.eni LDY&8F:LDA&D5Ø:STA&72CØ,Y:LDA&D51:STA&72C8,Y
:LDA&D52:STA&72DØ,Y:LDA&D53:STA&72D8,Y
 1Ø3ØLDA&8E:BNEANU:INC&8F:LDA&8F:CMP#4:BNEan1:LDA#1:ST
A&8E:.an1 JMPan2::.ANU DEC&8F:LDA&8F:CMP#Ø:BNEan2:LDA#
Ø:STA&8E
 1Ø4Ø.an2 LDY&8F:LDX#24Ø:LDA&72CØ,Y:STA&D5Ø:TXA:STA&72
CØ,Y:LDA&72C8,Y:STA&D51:TXA:STA&72C8,Y:LDA&72DØ,Y:STA&
D52:TXA:STA&72DØ,Y:LDA&72D8,Y:STA&D53:TXA:STA&72DØ,Y:R
TS
 1Ø5Ø]:NEXT:IF INKEY-256<>Ø AND INKEY-256<>-1 THEN A$=
"Electron":S=4Ø ELSE A$="BBC'B'":S=1ØØ
 1Ø6ØPRINTTAB((4Ø-LENA$)/2,5);A$;TAB(15,7);"Version .2
"'':delay?1=S:CHAIN""
```

```
   32ØSOUNDØ,1,5,1Ø:FORJ%=ØTO9:VDU19,2,1;Ø;:FORK%=ØTO2Ø
Ø:NEXT:VDU19,2,Ø;Ø;:FORK%=ØTO2ØØ:NEXT,
   34ØENDPROC
   35ØDEFPROCinstructions:CLS
   36ØPRINTTAB(15,Ø);"Locomotion"
   37ØPRINTTAB(14,1);STRING$(12,CHR$128);
   38ØPRINT''"  In this game you are in charge of a   r
unaway steam locomotive in which the   brakes have fai
led and there is no hope of stopping.However there are
 still moresetbacks to your journey."
   39ØPRINT"  From the air you are constantly being att
acked by aeroplanes and airships     while back on the
 rails some one has    unleashed a TRAIN SEEKING C-5!"
   4ØØPRINT"Luckly your train has an early warning  rad
ar system displayed on the bottom of the screen,it sho
ws you what is ahead onthe tracks or in the air.You mi
ght thinkthat such a train would be defenceless"
   41ØPRINT"not on your nelly,it's fitted with a    har
poon gun at the front to deal with   the C-5 and radio
active smoke to cope   with the planes.To fire the har
poon    simply press the space bar the smoke,   howev
er takes getting used to."
   42ØPRINT"  Firstly you can have upto three        pie
ces of smoke in the air at one time  but secondly,and
more importantly,the    longer you hold the fire button
 down thehigher the smoke goes,flying to the leftof th
e screen once released."
   43ØPRINTTAB(1,3Ø);"PLEASE PRESS THE SPACE BAR TO CON
TINUE"
   44ØREPEAT:UNTILINKEY-99
   45ØCLS:PRINTTAB(15,Ø);"Locomotion"
   46ØPRINTTAB(14,1);STRING$(12,CHR$128);
   47ØPRINT''"The keys to use in this game are :-"
   48ØPRINT'''"A  <->   UP          space  <->  FIRE"
   49ØPRINT'"Z  <->  DOWN         return <-> SMOKE"
   5ØØPRINTTAB(1,3Ø);"PLEASE PRESS THE SPACE BAR TO CON
TINUE":FORG=ØTO3ØØ:NEXT:REPEAT:UNTILINKEY-99:CLS:ENDPR
OC
   51ØDATA52,64,52,72,52,92,52,1ØØ,52,112,52,12Ø,52
   52ØDATA36,84,132,28,124,56,1Ø4,52,1ØØ,36,84,24,52,11
2,92,1Ø4,84
   53ØDEFPROCkey:PRINTTAB(5,24);"Locomotion"
   54ØREPEAT:UNTILINKEY-99
   55ØENDPROC
```

BLUFFERS' GUIDE TO MICROS

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

Every jargon has phrases which cause non-initiates to glaze over. Automobile hobbyists used to plunge families into catatonia by intoning the awful words, "Differential Gear". Computer addicts have a wider range of conversation killers: one forms our tasteful topic for today. Even those who've dabbled in Basic can turn pale at the far-off cry, "Control Structures!"

There's a chap in one of Moliere's plays who is delighted to find he's been *talking prose* all his life without knowing it. Similarly with Basic: if you've used an If-Then statement or a For-Next loop, then without knowing it you've been talking control structures. They're just methods of executing program statements in a controlled — conditional or repetitive — way.



Often Basic users have to lash together their own control structures, using the dreaded Goto statement. Saying Goto will cause upmarket programmers not to glaze over but to show snobbish disdain by hitting you in the mouth. For example, you may not know how many times your program needs to go around a loop. If it's supposed to count the full stops in *Robinson Crusoe* — somebody once did this — you want a loop structure with a conditional exit, like this:

```
10 GOSUB 1000 : REM find
   next full stop
20 STOPS = STOPS + 1
30 IF NOT ENDOFTEXT THEN
   GOTO 10
```

Subroutine 1000 contains the hard bits, and sets Endoftext as true when it at last reads the words "The End".

Basic is cruelly short of control structures; high-class languages usually offer three extra-powerful ones, called While, Repeat and Case.

The Crusoe example above is a home-made Repeat-Until loop. In Pascal it would look like this:

```
Repeat
  FindNextStop;
  Stops:= Stops+1
until EndOfText;
```

Pascal lets you write a Procedure called FindNextStop, which does the same as our old subroutine at line 1000. In this form the program chunk's much easier to understand — and the bug becomes visible. Suppose we've got a duff copy of *Crusoe* without any full stops? The routine still says there's one: anything inside a Repeat-Until is always executed at least once. Really we should be using a While loop. In Microsoft Basic it looks like this:

```
10 GOSUB 1000
20 WHILE NOT ENDOF TEXT
30 STOPS = STOPS + 1
40 GOSUB 1000
50 WEND
```

Here Wend is to While as Next is to For. The extra Gosub at line 10 checks the input before the loop: if "The End" is reached without finding any full stops, the While-Wend loop statements are never executed.

This is the point of powerful control structures and — pause for another turn-off phrase — "structured programming". It's not that they're upmarket and favoured by the Royal Family: just that the programs are easier to read and debug. Most of us still have to toil along with Basic, but one day . . .

DISPLAY HANDLING

The aspect of microcomputing in which machine-code routines are of greatest use is probably display handling, i.e. drawing, moving and animating graphics.

There exists in the Sinclair operating system several routines to facilitate this process, and the easiest way to manipulate the display from machine code is to use them. The Scroll routine, for example, will allow you to scroll not only the entire screen upwards, but any number of lines on it. You just have to know how to access this potential.

This feature of the Scroll routine allows you to effectively set up two separate "*windows*" in the display. The assembly language routine to scroll the lower five lines of the screen only is as follows:

LD B,5
CALL OEOO
RET (calls up Rom routine for Scroll)

To write out the entire routine — see pg 43, *The Complete Spectrum Rom Disassembly*, Dr I. Logan — would take time, patience and computer memory.

The computer must now be told to carry out these instructions. Each command in machine code corresponds to a number between 0 and 255. It is these numbers which the computer "understands" and can operate upon. The program must, therefore, be translated from "mnemonics" — above — to this code — below. Taking our previous example this code would be:

6
5
205
0
14
201

(continued on next page)

DISPLAY HANDLING

(continued from previous page)

...where 6 corresponds to LD B, etc. Substituting the 5 for another number changes the no. of lines to be scrolled.

To persuade the computer to look at these codes from Basic, they must first be programmed into an area of memory. A program to do this is shown below.

```
10 CLEAR 30000
20 DATA 6, 5, 205, 0, 14, 201
30 FOR X=0 TO 5
40 READ Y
50 POKE 30000 + X, Y
60 NEXT X
```

The aptly named command, Poke puts the number in Y into the memory location specified where it remains. Note that Clear 30000 reduces the amount of memory avaliable to the Basic user, but the program caters for 16K as well as 48K. If you do not wish to use up so much memory, and have 48K, 30000 may be replaced by 60000.

When you enter the program and run it, nothing will happen. But the machine code is now in memory. To use it, you need to give the machine code equivalent of Run; in this case it is USR 30000. Typing RANDOMISE USR 30000 will now scroll up the bottom five lines of the screen — you will, of course, see nothing if you have written nothing there to scroll. You can now incorporate the routine in your own program, if you wish to use a split screen for, say, graphics in the top part and text in the bottom.

This series of articles, over the next few months, sets out to give you routines such as this one, which you can include as part of you own Basic program to enhance it's speed or extend it's function — without knowing anything about assembly language.

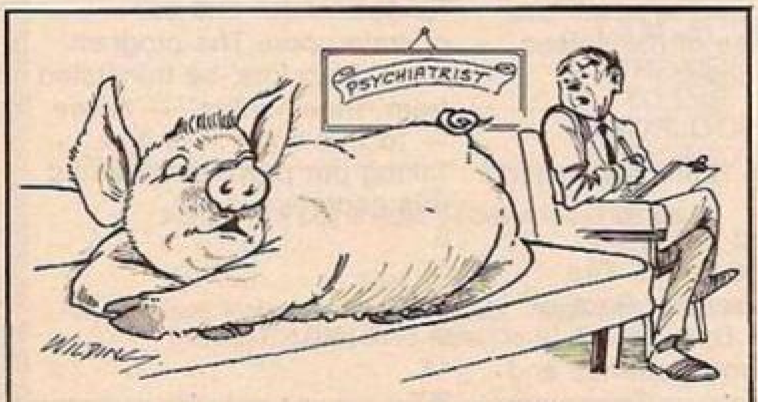
James Higgo

PROLOG

If you are familiar with programming in Basic, you will know what a bind it is to write database-type programs: programs that store sets of data, and allow users to update the data, and retrieve it in various ways. Basic's named variables and arrays are primitive tools, and its handling of disc and cassette files is poor in many versions.

There are many alternative languages which make this type of job simpler. Most of the list-processing school of languages — Lisp, full Logos and so on — concentrate on fitting the data into flexible structures, some of which let you describe specific relationships between the data items. Prolog, however, goes one step further. It concentrates on different ways of *retrieving* data.

In a session working with Prolog, you don't write a program: you set up, enhance or interrogate a database. The Prolog interpreter does most of the hard work of setting up a structure into which you can fit your data. It also provides you with search commands. You never need to write a search routine at all!



'So You think You are fifth Generation Language?'

Let's take a very simple example. This is a Prolog statement that could be taken to describe the eating patterns of cows:

food (cows, grass)

This one describes the appetite of pigs:

food (pigs, swill)

and this of one particular animal:

food (Napoleon, swill)

Store these in the computer, and then you can ask, in simple one-line phrases, questions like:

what do cows eat?
which animals eat grass?
do pigs eat swill?

These are the Prolog statements (they vary slightly from dialect to dialect) which do that:

```
?— food (cows, X)
?— food (Y, grass)
?— food (pigs, swill)
```

Type these in, and the computer will answer:

```
X = grass
Y = cows
Yes
```

It's as easy as that. Prolog can go further, though. You can also include in your database *rules* like:

if an animal eats grass, then it is a herbivore

if an animal eats swill, then it is a pig and the interpreter will then be able to answer questions like:

is a cow a herbivore?
is Napoleon a pig?

This ability to answer questions that have only indirect answers in the database makes Prolog an ideal language for writing artificial intelligence programs. Many expert systems have been written in Prolog. And the Japanese have chosen it for their Fifth Generation Project.

There are some drawbacks Prolog has a fixed method of searching its database, and it is essential to understand it and to structure the database carefully. Otherwise, the computer may come up with some wrong answers. It's also important to remember that the computer doesn't in any way understand the data that is fed in.

Its answers are not necessarily right: they are only logical deductions from the data, right or wrong, that is available.

Finally , in Prolog a "no" answer doesn't mean "That's wrong": only "That isn't provable from the database".

Big expert systems need big computers, of course: but mini Prolog interpreters are available for most home computers, and they can be put to real uses. As well as providing an easy way of setting up "intelligent" databases, they give the programmer a very rigorous training in thinking logically. That's one reason why Prolog is a great educational language.

Susan Curran.

Competition results

MUD CHALLENGE

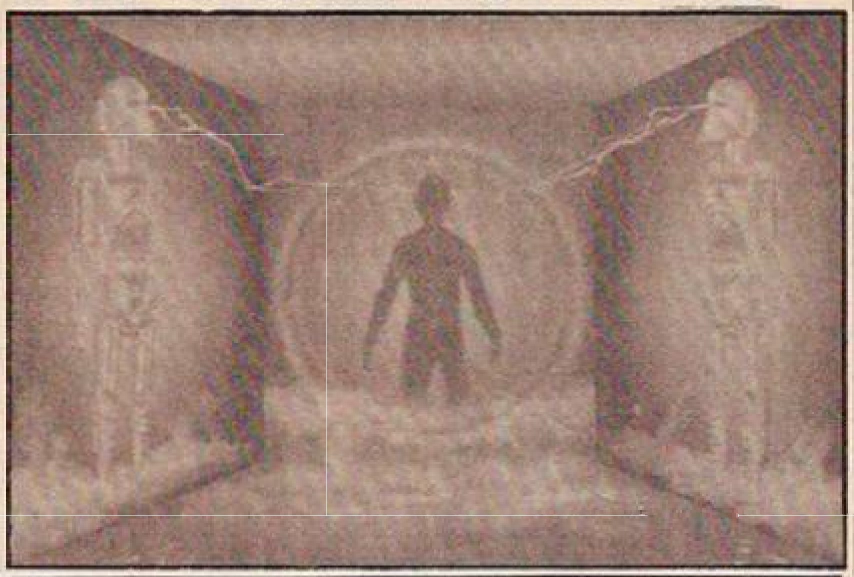
For the MUD competition in our September issue, we asked you to design a game which could be run using the MUD system. In particular it had to exploit the interactive nature of the system. Another problem with running a game on MUD is that it must be playable with only a small number of players or with many participating, and people must be able to come and go more or less at will.

Ideas ranged from the mystic past to the distant future. A common theme was interactive Elite. Dungeons and Dragons-type themes kept coming up, including one from Peter Luckham who suggested that, like the board-game, players should attempt to become skilled in one area, i.e., develop a certain number of spells, so that co-operation between these different types would be necessary.

The other runner-up was Per Landberger from Sweden who wanted to base his game on the suitably Scandanavian theme of the Vikings being generally unpleasant all over Europe. Players would take part in the raids and gather plunder and acquire status within their village.

The winner, however, found inspiration in the recent space opera *V*. Stephen Jetley's scenario involved players joining resistance bands and going on various assignments. This would seem to suit the system well. The type of raid generated would depend on the number of players logged on, and people could enter the party at will. Obviously more experienced players would know the system better and therefore the other players would look to them for guidance.

So Stephen Jetley will go forwared as YC's champion to the great MUD challenge.



PHILIPS MONITOR

This competition attracted one of our largest ever entries, well over a 1000 of them. This is probably because just about anyone who's got a computer would like a monitor, but few can justify the cost to themselves, parents or spouses. Indeed, domestic bliss was one of the commonest reasons put foward for wanting one. It seems that many computer users have to fit in Elite or Doomdark's Revenge between Wogan and Dallas, inevitably leading to ructions.

I'm afraid that we're a heartless crowd here, you'll just have to sort out your own domestic problems. Another common theme was people wanted a set that couldn't pick up Terry Wogan. Laudable though this aim is, I'm sure the indefatigable Mr Wogan will find a way to get himself on to monitors as well. After all, he has monopolised every other form of electrical equipment, and there is even talk that you can get him on some microwaves.

Some complained that while their computer was state of the art, their TV was a little over the hill. The best of these was Kevin Lowe, who claimed John Logie Baird wanted his set back. Foremost in the slogan market was Mr JW Smith from Shetland who claimed that "Philips packs pixel power".

And so we come to the winners. Runner ups were Andrew Callister from Douglas, Isle of Man. A Philips monitor to him meant no more trouble with the Fuzz — presumably he won't get done for license evasion again. Another runner up was R Laskey from St Albans. He claimed that "dedication was so hard to find nowadays." However, winner by a clear pixel from all the thousands of entries was Mark Bentall from Sheppey, Kent:

I asked my computer, a BBC B,
What make of monitor it would most like to see.
With a clunck and a whirl and a giggle of glee.
It just be a Philips CM -8533.

TOUR DE FRANCE

October's Tour de France competition asked you to redesign the circuit for Activision's bicycle racing game. 20 copies of the game together with a Tour sweatshirt were on offer for the runners up; and for the winner we threw in a Commodore 64 to play the game on.

Most entries wanted to make the course longer and tougher — as if the present circuit wasn't gruelling enough already. They also thought to change the venue. Thus we had Tours of Australia, Europe, Sweden, Atlantis, Saturn's Rings, and, from a Yugoslavian reader, a nicely illustrated Tour of America. Other suggestions included a race round the coast of France on hydro bikes, and a circuit based on Birmingham's Spaghetti Junction twisted into the shape of a Mobius band.

First prize goes to Neil Marsh, 25 Oxford Road, Orrell, Wigan, Gr. Manchester. As his extract from the Bike-Rider's Guide to the Galaxy points out, the most demanding circuit in the universe is located in the Rof mountains on the planet Orhim. Due to a freak rift in the fabric of space, the entire circuit is uphill.

Copies of the game and sweatshirts to the following: E. Cook, Cwmbran; O. Sjostrand, Sweden; A. Alldrick, Coventry; M. Shillaker, Corsham; S. Whitehouse, Halesowen; R. Sheppard, Chingford; R. Stesevic, Yugoslavia; M. Mobarak, Milton Keynes; T. Chapman, Ashwell; H. Sandhar, Wolverhampton; L. Porsklev, Sweden; R. Fleuty, Eastbourne; M. Roberts, Burgess Hill; M. Whiley, Knutsford; S. McRae, Inverurie; M. Woods; M. Lockwood, Huddersfield; J. Williams, Stoke; P. Holland, Wirral; A. Ennis, Herne Hill.

SUMMER OF GAMES II

£100 of sportswear plus a copy of Summer Games II, was the prize in October's comptition based on US Gold's hit game. We asked you to come up with a new event for the game. S. Jardine, 108 Barrowby Road, Grantham, Lincs., wins the prze for a Trapeze event: points would be awarded for smooth landings, artistic interpretation, number of somersaults, and so on, while timing would be absolutely crucial. Among the other entries, fishing and C5 racing were suggested, but were rejected on the grounds that they would be too slow.

30 copies of the game go to the following runners up: J. Green, Radlett; A. Ennis, Herne Hill; J. Williams, Stoke-on-Trent; C. Fyre, Codnor; J. Tunstall, Hartlepool; A. Shaw, Nailsea; P. Croxall, Farby; C. Broad, Oldham; W. Sonner, Folkestone; R. Stewart, Tinsley; F. Turra, Bologna; K. Young, Coventry; P. Cheesbrough, Keswick; M. Hatton, Morpeth; S. Ahmad, Crawley; J. Morris, Poole; P. Williams, Rushton; S. Whitfield, Beverley; P. Barker, Battersea; D. Constable, Upmister; J. King, Belgium; A. Charles, South Anston; C. Macaskill, Alloa; A. Brett, Broadmeadows; D. Johnson, Stockport; T. Wells, Stourbridge; S. Davies, Wyrtley; J. Norris, Beckenham; J. Salfarlie, Mitcham; P. Sandell, Sweden.


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RESPONSE FRAME

POINTER PROBLEMS

Do you have a problem related to your micro? Our team will do their best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you have an idea you'd like to pass on to others. Why not write to us with your top tips?

●I am developing a drawing program for the Amstrad. How can I move a pointer around the screen without overwriting the background? Also, could you tell me how to incorporate pull-down menus.
Simon Modi,
Prestel Mailbox.

Although it is not well explained in the manual, the Amstrad has four different "ink modes" which determine how a pixel or a line interacts with colours already on the screen. Ink mode 1, XOR, the exclusive OR option provides a simple solution to your problem. In this mode, drawing a line or printing a character twice has the effect of restoring the original picture.

You can set the XOR mode by including a fourth parameter at the end of a plotting command such as Plot or Draw; or by Printing control character 23. The following program illustrates the technique. Lines 10 to 30 create a background, Line 80 simply causes a delay.

```
10   FOR N=1 TO 1000
20   PRINT "M";
30   NEXT
40   PRINT CHR$(23) + CHR$(1)
50   TAG
60   MOVE 50,100
70   PRINT "TEST";
80   FOR D=1 TO 1000:NEXT
90   MOVE 50,100
100  PRINT "TEST";
```

If you want to include pull-down menus, I am afraid you will have to learn machine code. You'd need first to store part of the screen, print the menu, and then reprint the original screen data. Doing this from Basic would be too slow.
Jim Taylor.

SIMULATING A PAUSE

●I have been delving into the depths of machine-code for a while now and have met with a problem. How do I simulate the pause function but only allow one key to continue the operations? For example: If one was to save chunks of code headerless one after the other, how would I go about making the system wait for, say, Capshift to be pressed, thus continuing with the save?
Mark Plumett,
Thetford,
Norfolk.

The principle of pausing in machine code is fairly similar to Basic. Consider the following:

```
10   LET I$ = INKEY$
20   IF I$ = " " THEN GOTO 100
30   GO TO 10
40   STOP
100  REM continue with program
```

The way to do this in machine code is to read the keyboard and keep doing so in a continuous loop until such time that the key depressed is the one required. So if you want to save two blocks of headerless code with a pause 0 equivalent in between, use the following:

```
LD HL, START OF SAVE
LD DE, LENGTH OF CODE
LD A, 255 (LENGTH OF LEADER)
SCF
CALL 04C2 (SAVE BYTES)
LD A, CODE OF KEY
LOOP IN A, (254)
RRA
JR C, LOOP
LD, HL, START OF SAVE
LD DE, LENGTH
LD A, 255 (LEADER)
SCF
CALL 04C2 (S/B)
RET.
```

This routine works on all of the outside keys. Here are their values.

1 — 247
0 — 239
Q — 251
P — 223
A — 253
ENTER — 191
CAPS — 254
BREAKSPACE — 127

Craig Rawston

WHICH COMPILER?

●In the June issue of *Your Computer* you answered a letter about a compiler for the Spectrum. You advised Softek's FP-Compiler, as it is the best you know. Please could you give me a little more information on this compiler, like what sort of speed increase it has, how much user memory it provides and how much it costs.
S Smith,
Minster Lovell,
Oxon.

Basically the Compiler Pack is made up of two separate compilers F.P. and I.S. The "Floating Point" version supposedly speeds up your programs by 10 times (about right) and the Integer version between 200 and 500 times.

To be realistic the latter is more like 5-10 time average.

Obviously the more complicated the program is the slower the compiled code will be. Both programs fit fairly high up in the memory so a large chunk is available to the user.

Although most operations are catered for I would disagree with Tim Hartnell and say that 'Blast' from Oxford Computer Systems Ltd is far superior, but then for £24.95 it should be. FP will set you back around £19.95 and is available in the shops whereas Blast is only available by post. The less extensive but faster Softek Computer, I.S., costs £9.95.

Oxford Computer Systems Ltd — 0993 812700; The Edge — 01-240 1422/7877.
Craig Rawston.

TOP TIPS

This short piece of machine code — 179 bytes — which will list the current variables in memory. It works on any Spectrum. Type in the program below and run it. If there are no errors it will then save the machine code it creates to tape.

The routine is leaded by LOAD "" CODE but first reserve memory with CLEAR 59999. To call LVAR from Basic enter. RANDOMISE USR 60000.
Non-printable characters are handled by + CHRS n +, where n is a character from 0 to 32.
Anant Modi

```
10 DEF FN a(a$)=CODE a$-48-7*(a$>"9")-32*(a$>"Z"): DEF FN h(a$)=FN a(a$(1))*16+FN a(a$(2))
20 LET a=60000: FOR x=100 TO 120 STEP 10
30 READ a$: LET t=VAL a$( TO 5): LET a$=a$(6 TO )
40 POKE a,FN h(a$): LET t=t-PEEK a: LET a=a+1
50 LET a$=a$(3 TO ): IF a$<>"" THEN GO TO 40
60 IF t THEN PRINT AT 16,0;"Error in line ";x: STOP
70 NEXT x: PRINT AT 16,0;"All OK - Saving code"
80 SAVE "LVAR"CODE 60000,179
100 DATA "[illegible]"
110 DATA "[illegible]"
120 DATA "[illegible]"
```

Software File

Programs for Software File should be fairly compact and sent on a cassette. Please include clear instructions and say what computer it's for. We pay between £6 and £36 for programs published. They must be double-checked and submitted to *Your Computer* exclusively.

SYNTHESISER

▶David Walker ● Amstrad ● Knighton, Powys

After typing in the listing and successfully running it several inputs will have to be made before you can make the program play music.

You will input the octave number. The attack rate — how fast the sound reaches its peak volume. The lower the number the faster this happens. The decay rate — how fast the sound drops to its constant volume.

The release rate — how fast when you have released the key the sound decays away. The tone effect. You can experiment with all the preset sounds in lines 600-700 and alter them if you wish. After these inputs your keyboard will be live.

Synthesiser.

```
1 REM  David Walker 1985
2 REM  Synthesiser
1Ø GOSUB 37Ø
2Ø EVERY 4,3 GOSUB 25Ø
3Ø EVERY 4,2 GOSUB 29Ø
4Ø EVERY 4,1 GOSUB 33Ø
5Ø FOR x=1 TO 13
6Ø IF INKEY(k%(x))=Ø AND x<>c1 AND x<>c2 A
ND x<>c3 THEN GOSUB 9Ø
7Ø NEXT x
8Ø GOTO 5Ø
9Ø IF c1=Ø THEN GOSUB 1ØØ ELSE IF c2=Ø THE
N GOSUB 15Ø ELSE IF c3=Ø THEN GOSUB 2ØØ EL
SE RETURN
1ØØ IF x<>Ø AND x=c2 OR x=c3 THEN RETURN
11Ø SOUND 129,p%(x),Ø,Ø,1,tone
12Ø SOUND 129,p%(x),1ØØØØ,12,Ø,tone
13Ø c1=x
14Ø RETURN
15Ø IF x<>Ø AND x=c1 OR x=c3 THEN RETURN
16Ø SOUND 13Ø,p%(x),Ø,Ø,1,tone
17Ø SOUND 13Ø,p%(x),1ØØØØ,12,Ø,tone
18Ø c2=x
19Ø RETURN
2ØØ IF x<>Ø AND x=c1 OR x=c2 THEN RETURN
21Ø SOUND 132,p%(x),Ø,Ø,1,tone
22Ø SOUND 132,p%(x),1ØØØØ,12,Ø,tone
23Ø c3=x
24Ø RETURN
25Ø IF c1=Ø OR INKEY(k%(c1))=Ø THEN RETURN
26Ø SOUND 129,p%(c1),Ø,12,2,tone
27Ø c1=Ø
28Ø RETURN
29Ø IF c2=Ø OR INKEY(k%(c2))=Ø THEN RETURN
3ØØ SOUND 13Ø,p%(c2),Ø,12,2,tone
31Ø c2=Ø
32Ø RETURN
33Ø IF c3=Ø OR INKEY(k%(c3))=Ø THEN RETURN
34Ø SOUND 132,p%(c3),Ø,12,2,tone
35Ø c3=Ø
36Ø RETURN
37Ø DEFINT a-z
38Ø DIM p%(13),k%(13)
39Ø FOR x=1 TO 13
4ØØ READ k%(x)
41Ø NEXT
42Ø MODE 1
43Ø INPUT"octave (1-5)";o
44Ø IF o=1 THEN RESTORE 77Ø
45Ø IF o=2 THEN RESTORE 78Ø
46Ø IF o=3 THEN RESTORE 79Ø
47Ø IF o=4 THEN RESTORE 8ØØ
48Ø IF o=5 THEN RESTORE 81Ø
49Ø FOR x=1 TO 13
5ØØ READ p%(x)
51Ø NEXT
52Ø MODE 1
53Ø INPUT"attack rate (Ø-5)";attack
54Ø INPUT"decay rate (Ø-5)";decay
55Ø INPUT"release rate (1-1Ø)";rel
56Ø ENV 1,5,3,attack,2,-1,decay
57Ø ENV 2,12,-1,rel
58Ø MODE 1
59Ø INPUT"Which tone effect (1-15)";tone
6ØØ ENT -1,3,1,1,3,-1,1
61Ø ENT -2,3,2,1,3,-2,1
62Ø ENT -3,6,1,1,5,-1,1
63Ø ENT -4,6,2,1,6,-2,1
64Ø ENT -5,5,1,1,1Ø,-1,1,5,1,1
65Ø ENT -6,2,1,1,4,-1,1,2,1,1
66Ø ENT -7,2,2,1,4,-2,1,2,1,1
67Ø ENT -8,2,1,2,4,-1,2,2,1,2
68Ø ENT -9,5,1,1,2,-1,1,5,1,1,8,-1,1
69Ø ENT -1Ø,3,5,1,3,-1Ø,1,3,5,1
7ØØ ENT -11,1,1,1
71Ø ENT -12,1,-1,1
72Ø ENT -13,2Ø,1,1,1Ø,-2,1
73Ø ENT -14,5,1Ø,1,1Ø,-5,1
74Ø ENT -15,5,1,1,6,-1,1
75Ø RETURN
76Ø DATA 71,6Ø,63,61,62,55,52,54,44,46,45,
38,39
77Ø DATA 956,9Ø2,851,8Ø4,758,716,676,638,6
Ø2,568,536,5Ø6,478
78Ø DATA 478,451,426,4Ø2,379,358,338,319,3
Ø1,284,268,253,239
79Ø DATA 239,225,213,2Ø1,19Ø,179,169,159,1
5Ø,142,134,127,119
8ØØ DATA 119,113,1Ø6,1ØØ,95,89,84,8Ø,75,71
,67,63,6Ø
81Ø DATA 6Ø,56,53,5Ø,47,45,42,4Ø,38,36,34,
32,3Ø
```

PILE-UP

▶David Judge ● BBC ● Surbiton, Surrey

This is a strategy game for the BBC model B — with OS 1.2 — for two players. It is played on a 10 by 10 board. Each player takes it in turn to place a counter of his or her colour onto a square on the board.

To place a counter on the board, you simply move the cursor — a cross on the board — to the desired square, using the cursor keys, and press the space bar. You may also use joysticks.

When there are more than five counters "piled up" onto a single square, that square explodes, and throws counters into the surrounding squares. If there are any of the opponent's counters in these squares, then they are wiped out.

The object of the game

(continued on next page)

File

(continued from previous page)

is to take over the entire board with your own coloured counters.

The strategy of the game is more complex than it at first appears. For instance, one strategy is to build up a chain of squares each containing five counters, until you consider that it is the right time to set off the chain. Another strategy is to explode squares as soon as possible, in order to take over a lot of the board quickly.

The game is in two parts. The first part gives the game instructions, while the second part is the game itself. Type in listing 1 and save it onto the start of a cassette.

SAVE "PILE" <RETURN>

Then enter listing 2 and save that after listing 1 on the same cassette.

SAVE "PILE2" <RETURN>

Then rewind the cassette and run the game by typing:

CHAIN "" <RETURN>

The game as written will run on disc-based machines without the need for a downloader, as there is sufficient memory for the program to run with Page set to &1900.

The program has not been tested on an Electron. However, if all references to Mode 7 are removed, the program should run.

Listing 1 can, in fact, be left out altogether.

If anybody would like to play the game without having to type it all in, a cassette of the program is available for £3.00 from me. Please send a cheque or postal order for £3.00 to: David Judge, 39 Warren Drive North, Tolworth, Surbiton, Surrey.

Listing 1.

```
  10MODE 7
  20PROCintro
  30CLS
  40PRINT
  50FOR J=1 TO 2
  60PRINTTAB(12);CHR$(131);CHR$(131);CHR$(157);CHR$(1
32);CHR$(141);"Pile up   ";CHR$(156)
  70NEXTJ
  80PRINT''''
  90CHAIN "PILE2"
 100DEFPROCintro
 110CLS
 120PRINT
 130FOR J=1 TO 2
 140PRINTTAB(12);CHR$(131);CHR$(131);CHR$(157);CHR$(1
32);CHR$(141);"Pile up   ";CHR$(156)
 150NEXTJ
 160PRINT
 170PRINT"      This is the game ofPile up"
 180PRINT'"The game is for two players. Each player";
 190PRINT"takes it in turn to place one of their"
 200PRINT"counters on the 10 * 10 board. "
 210PRINT"When their are more then 5 counters on "
 220PRINT"a space, this space explodes and throws"
 230PRINT"counters into the surrounding squares."
 240PRINT"These squares will then take on the same";
 250PRINT"colour as the exploding square."
 260PRINT"One player is blue, the other is red."
 270PRINT"The object of the game is to convert the";
 280PRINT"whole board to your own colour."
 290PRINT"There is an option for either joysticks"
 300PRINT"or keyboard play. If the keyboard option";
 310PRINT"is selected, then use the cursor keys to";
 320PRINT"move and the space bar to pick a square."
 330PRINT" HIT ANY KEY TO CONTINUE ";
 340A$=GET$
 350CLS
 360PRINT
 370PRINT"The rules:-"'
 380PRINT"1)   You can only place a counter in an"
 390PRINT"     empty square, or one already "
 400PRINT"     occupied by one of your counters."
 410PRINT"2)   With the joystick option, it is "
 420PRINT"     necessary to have one joystick for"
 430PRINT"     each player."'
 440PRINT"There are 3 options for the length of"
 450PRINT"each game, either short, medium or long."'
 460PRINT" HIT ANY KEY TO CONTINUE ";
 470A$=GET$
 480ENDPROC
```

Listing 2.

```
  1REM LISTING 2
 10ON ERROR MODE 3:REPORT:PRINTERL:END
 20DIM B(11,11)
 30VDU23,240,255,255,255,255,255,255,255,255
 40FOR J=1 TO 11
 50FOR K=1 TO 11
 60B(J,K)=0
 70NEXT K
 80NEXT J
 90PROCstart
100TIME=0
110MODE2
120VDU 23;8202;0:0:0
130movs=0
140PROCscreen
150PRINTTAB(15,1);"MOVES"
160PRINT TAB(15,6);"TIME"
170FOR JX=1 TO 10
180FOR JY=1 TO 10
190IF B(JX,JY)<>0 THEN PROCsquare
200NEXT JY
210NEXT JX
220REPEAT
230PRINTTAB(15,3);STR$(movs);
240PROCtime
250PROCplay1
260PROCcheck
270PROCplay2
280PROCcheck
290movs=movs+1
300PROCboard
310UNTIL FALSE
320
330DEFPROCscreen
340CLG
350VDU29,0;112;
360VDU19,1,7;0;0;0;
370VDU19,2,1;0;0;0;
380VDU19,3,4;0;0;0;
390GCOL 0,1
400FOR J=0 TO 800 STEP 80
410MOVE J,0:DRAW J,800
420NEXT J
430FOR J=0 TO 800 STEP 80
440MOVE 0,J:DRAW 800,J
450NEXT J
460ENDPROC
470
480DEFPROCplay1
490PROCdisp(1)
500flag1=1
510IF key THEN PROCkeys ELSE PROCjoy1
520B(JX,JY)=B(JX,JY)+1
530PROCsquare
540ENDPROC
550
560DEFPROCplay2
570PROCdisp(2)
580flag1=-1
590IF key THEN PROCkeys ELSE PROCjoy2
600B(JX,JY)=B(JX,JY)-1
610PROCsquare
620ENDPROC
630
640DEFPROCjoy1
650JX=1:JY=1
660REPEAT
670PROCtime
680PROCcross
690A1=ADVAL(1)
700A2=ADVAL(2)
710A3=ADVAL(3)
720A4=ADVAL(4)
730F0=ADVAL(0) AND 3
740IF F0=1 THEN PROCcross:GOTO 820
750IF ((A1>30000 AND A1<35000) AND (A2>30000 AND A2<
35000)) THEN 690
760IF (A1<1000 AND JX=10) OR (A1>60000 AND JX=1) OR
(A2>60000 AND JY=10) OR (A2<1000 AND JY=1) THEN 690
770PROCcross
780IF A1<1000 JX=JX+1
```

File

```
790IF A1>60000 JX=JX-1
800IF A2<1000 JY=JY-1
810IF A2>60000 JY=JY+1
820UNTIL F0<>0
830 IF B(JX,JY)<0 THEN 660
840ENDPROC
850
860DEFPROCkeys
870JX=1:JY=1:*FX15
880REPEAT:PROCtime:PROCcross
890A=GET
900IF A=32 THEN PROCcross:GOTO 980
910IF A<136 OR A>139 THEN 890
920IF (A=136 AND JX=1) OR (A=137 AND JX=10) OR (A=13
8 AND JY=1) OR (A=139 AND JY=10) THEN 890
930PROCcross
940IF A=136 THEN JX=JX-1
950IF A=137 THEN JX=JX+1
960IF A=138 THEN JY=JY-1
970IF A=139 THEN JY=JY+1
980OSCLIA=32
990IFB(JX,JY)<>0 AND SGN(B(JX,JY))<>flag1 THEN 880
1000ENDPROC
1010
1020DEFPROCcross
1030CX=((JX-1)*80)+40
1040CY=((JY-1)*80)+40
1050GCOL3,1
1060MOVE CX-20,CY
1070DRAW CX+20,CY
1080MOVE CX,CY-20
1090DRAW CX,CY+20
1100ENDPROC
1110
1120DEFPROCjoy2
1130JX=1:JY=1
1140REPEAT
1150PROCtime
1160PROCcross
1170A1=ADVAL(1)
1180A2=ADVAL(2)
1190A3=ADVAL(3)
1200A4=ADVAL(4)
1210F0=ADVAL(0) AND 3
1220IF F0=2 THEN PROCcross:GOTO 1300
1230IF ((A3>30000 AND A3<35000) AND (A4>30000 AND A4<
35000)) THEN 1170
1240IF (A3<1000 AND JX=10) OR (A3>60000 AND JX=1) OR
(A4>60000 AND JY=10) OR (A4<1000 AND JY=1) THEN 1170
1250PROCcross
1260IF A3<1000 JX=JX+1
1270IF A3>60000 JX=JX-1
1280IF A4<1000 JY=JY-1
1290IF A4>60000 JY=JY+1
1300UNTIL F0<>0
1310IF B(JX,JY)>0 THEN 1140
1320ENDPROC
1330
1340DEFPROCboard
1350chk=0
1360FOR J=1 TO 10
1370FOR K=1 TO 10
1380IF B(J,K)=0 THEN 1400
1390IF B(J,K)<0 THEN chk=chk-1 ELSE chk=chk+1
1400NEXT K
1410NEXT J
1420IF chk=100 OR chk=-100 THEN PROCend
1430ENDPROC
1440
1450DEFPROCcheck
1460change=0
1470FOR J=1 TO 10
1480FOR K=1 TO 10
1490IF B(J,K)>-6 AND B(J,K)<6 THEN 1590
1500IF B(J,K)<=-6 THEN flag=-1 ELSE flag=1
1510FORJ1=J-1 TO J+1
1520FORK1=K-1 TO K+1
1530IF RND(1)<.8 THEN PROCchange
1540IF J1=J AND K1=K THEN PROCchange
1550NEXT K1
1560NEXT J1
1570change=1
1580SOUND 0,-15,5,10
1590NEXT K
1600NEXT J
1610IF change=0 THEN ENDPROC
1620PROCtime
1630PROCboard
1640GOTO 1460
1650ENDPROC
1660
1670DEFPROCchange
1680IFJ1<1 OR K1<1 OR J1>10 OR K1>10 THEN ENDPROC
1690JX=J1:JY=K1
1700IF J1=J AND K1=K B(J,K)=flag:PROCsquare:ENDPROC
1710IF SGN(B(J1,K1))<>flag THEN B(J1,K1)=flag:PROCsqu
are:ENDPROC
1720B(J1,K1)=B(J1,K1)+flag
1730PROCsquare
1740ENDPROC
1750
1760DEFPROCtime
1770T1=INT(TIME/100)
1780T2=T1 DIV 60
1790T3=T1 MOD 60
1800T2$=""
1810IF T2<10 THEN T2$="0"+RIGHT$(STR$(T2),1) ELSE T2$
=RIGHT$(STR$(T2),2)
1820T3$=""
1830IF T3<10 THEN T3$="0"+RIGHT$(STR$(T3),1) ELSE T3$
=RIGHT$(STR$(T3),2)
1840T4$=T2$+":"+T3$
1850PRINTTAB(15,8);T4$
1860ENDPROC
1870
1880DEFPROCend
1890IF chk=100 THEN COLOUR 2 ELSE COLOUR 3
1900REPEAT
1910PRINTTAB(15,12);
1920IF chk=-100 THEN PRINT"BLUE"; ELSE PRINT"RED ";
1930FOR K=1 TO 1000:NEXT K
1940PRINTTAB(15,12);"    ";
1950FOR K=1 TO 1000:NEXT K
1960UNTILFALSE
1970
1980DEFPROCsquare
1990VDU5
2000JX1=((JX-1)*80)+10
2010JY1=((JY-1)*80)+60
2020MOVE JX1,JY1
2030IF B(JX,JY)>0 THEN GCOL 0,2 ELSE GCOL 0,3
2040IF B(JX,JY)>=5 THEN GCOL 0,9
2050IF B(JX,JY)<=-5 THEN GCOL 0,12
2060PRINTCHR$(240);
2070GCOL 0,1
2080MOVE JX1,JY1
2090PRINTCHR$(ABS(B(JX,JY))+48);
2100VDU4
2110ENDPROC
2120
2130DEFPROCstart
2140CLS:PRINT
2150PRINT'"Do you want sound (Y/N)";
2160REPEAT
2170A$=GET$
2180UNTILA$="Y" OR A$="N"
2190IF A$="Y" THEN 2220
2200*FX210,1
2210GOTO 2230
2220*FX210,0
2230PRINT'''
2240key=FALSE
2250PRINT
2260PRINT"Would you like a :-    1   Keyboard game"
2270PRINT"                       2   Joystick game"
2280REPEAT:A$=GET$:UNTILA$="1" OR A$="2"
2290IF A$="1" THEN key=TRUE:*FX4,1
2300PRINT'''
2310PRINT"Would you like a :-    1   long game"
2320PRINT"                       2   medium game"
2330PRINT"                       3   short game"
2340REPEAT
2350A$=GET$
2360UNTILA$="1" OR A$="2" OR A$="3"
2370IF A$="1" THEN ENDPROC
2380IF A$="2" THEN max=40 ELSE max=80
2390FOR J=1 TO max
2400X=INT(RND(1)*10)+1
2410Y=INT(RND(1)*10)+1
2420IF B(X,Y)<>0 THEN 2400
2430val=INT(RND(1)*4)+1
2440IF RND(1)>.5 THEN val=val*-1
2450B(X,Y)=val
2460NEXTJ
2470ENDPROC
2480
2490DEFPROCdisp(p)
2500IF p=1 THEN COLOUR 2 ELSE COLOUR 3
2510PRINTTAB(0,0);"PLAYER ";p;" "
2520COLOUR 1
2530ENDPROC
```

File

LABELS

▶*M Payne* ● *Spectrum*
● *Milton, Stoke-on-Trent*

This program allows labels to be used on the Spectrum. It is written in such a way that it may be used with a line renumberer thus adding greater versatility to program development. By using meaningful labels you can forget about line numbers and settle down to writing some readable, structured programs. Points to note:

- A label is stored as a variable containing the value of the line number on which it appears.
- A label is defined by a Rem statement followed by an asterisk followed by the label name.
- No other text may appear with a label — each label must have a line of its own.
- This program must precede any program using labels.
- Labels must not be longer than 20 characters.

The program is searched for label declarations, and when found, the label name is poked into the Let statement on the second line. This statement is then executed and the search continues until the end of the program. Note – the Go Sub statement, and the For z=0 TO 0 Step 0 statement are methods of avoiding direct jumps involving line numbers.

Labels.

```
   1 LET pointer=Ø
   2 LET payney                    =PEEK (pointer+1)+256*PEEK pointer: IF
 pointer<>Ø THEN  RETURN
   3 LET start=26+PEEK 23635+256*PEEK 23636
  1Ø LET pointer=start-26
  2Ø LET nextaddr=pointer
  25 FOR z=Ø TO Ø STEP Ø
  3Ø LET pointer=nextaddr
  4Ø LET nextaddr=pointer+PEEK (pointer+2)+256*PEEK (pointer+3)+4
  5Ø IF PEEK (pointer+5)<>CODE "*" THEN  GO TO 1ØØ
  55 LET length=PEEK (pointer+2)+256*PEEK (pointer+3)-3
  6Ø IF length>2Ø THEN  PRINT "label error - line ";PEEK (pointer+1
)+256*PEEK pointer,stoprun
  62 FOR n=1 TO length
  65 POKE start+n-1,PEEK (pointer+5+n)
  7Ø NEXT n
  75 FOR n=length TO 19
  8Ø POKE start+n,32
  85 NEXT n
  9Ø GO SUB 1+PEEK (start-25)+256*PEEK (start-26)
 1ØØ IF pointer<PEEK 23627+256*PEEK 23628 THEN  NEXT z
 11Ø REM
 12Ø REM ----------------------
 13Ø REM Payney 1984
 14Ø REM ----------------------
 15Ø REM
1ØØØ REM next line is a label
1ØØ5 REM *example1
1Ø1Ø PRINT "example1=";example1
1Ø2Ø REM *error: REM label must apper on its own line
```

SQUIGGLE

▶*Robert Bain* ● *Spectrum*
● *Dorset*

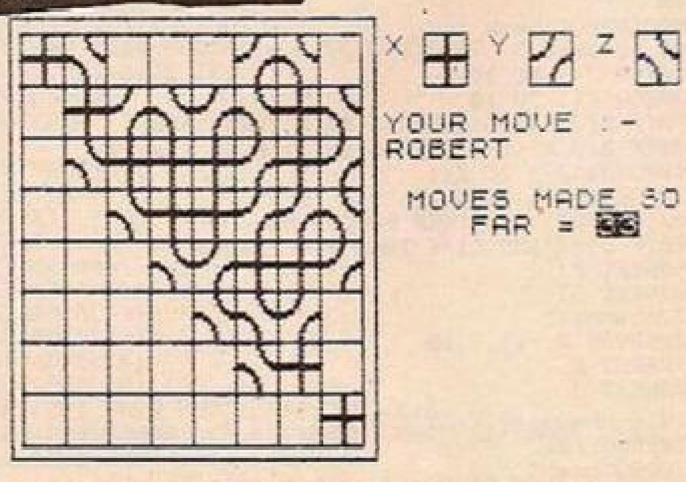
Squiggle is about 8K long. the game has no machine code. When first run, it may look simple but in reality it is fairly complex and many hours of fun can be obtained from it.

The idea of Squiggle is to complete a continuous line from the top left-hand corner of the board to the bottom right-hand corner, or to force your opponent off the edge of the board. All the player is required to do is input the letter of the piece he/she wishes to place at the end of the line and the computer will do the rest.

As the first piece is placed to the right of the start square placing piece Y will automatically lose the player the game.

A running score is kept of how many games each player has won and if different players want to play the names can be changed and the scores reset.

Squiggle.



SQUIGGLE

```
  10 REM ***** SQUIGGLE FOR THE
SPECTRUM & SPECTRUM+ *****
  20 REM ***** BY ROBERT BAIN ©
15 JUNE 1985 *****
  30 BORDER 1: PAPER 1: INK 7: C
LS : POKE 23658,8
  40 GO SUB 9000: GO SUB 8000: G
O SUB 7000
  50 CLS : PRINT AT 9,0; FLASH 1
;P$(START);AT 11,0;"STARTS THIS
TIME"
  60 PRINT #0; INVERSE 1; INK 5;
"PRESS A KEY TO PLAY."
  70 IF INKEY$="" THEN GO TO 70
  80 PRINT #0;AT 1,0;"
             ": LET PLAYER=START
  85 LET MVES=0: LET AX=1: LET A
Y=2: LET X=1: LET Y=3: LET X1=1:
 LET Y1=1: FOR A=1 TO 8: FOR B=1
 TO 8: LET A(A,B)=0: NEXT B: NEX
T A: LET A(1,1)=1: GO SUB 6000
  90 PRINT AT 5,18; INK 5;P$(PLA
YER): BEEP .1,10
 100 OVER 1: LET Z$=INKEY$
 110 IF Z$<"X" OR Z$>"Z" THEN GO
 TO 100
 120 IF Z$="X" THEN PRINT AT X,Y
;A$(1);AT X+1,Y;A$(2): LET A(AX,
AY)=1
 130 IF Z$="Y" THEN PRINT AT X,Y
;B$(1);AT X+1,Y,B$(2): LET A(AX,
AY)=2
 140 IF Z$="Z" THEN PRINT AT X,Y
;C$(1);AT X+1,Y;C$(2): LET A(AX,
AY)=3
 150 OVER 0: GO TO 5000
 160 IF PLAYER>2 THEN LET PLAYER
=1
 170 PRINT AT 8,28; INVERSE 1;MV
ES
 180 GO TO 90
3000 REM TITLE
3020 PRINT AT A,B; INK C;"SQ
UIGGLE"
3030 RETURN
3040 RESTORE 3060
3045 READ A: READ B: IF A=255 TH
EN RETURN
3050 PRINT AT A+1,B+3; INK 0;"■"
: PRINT AT A,B+2; INK C;"■"
3055 GO TO 3045
3060 DATA 6,0,6,1,6,2,7,0,8,0,8,
1,8,2,9,2,10,0,10,1,10,2,7,4,7,5
,7,6,8,4,8,6,9,4,9,5,9,6,10,6,11
,6,12,6,12,7,7,8,7,10,8,8,8,10,9
,8,9,9,9,10
3070 DATA 5,12,7,12,8,12,9,12,7,
14,7,15,7,16,8,14,8,16,9,14,9,15
,9,16,10,16,11,14,11,15,11,16,7,
18,7,19,7,20,8,18,8,20,9,18,9,19
,9,20,10,20,11,18,11,19,11,20
3080 DATA 5,22,6,22,7,22,8,22,9,
22,9,23,6,25,6,26,6,27,7,25,8,25
,8,26,8,27,9,25,10,25,10,26,10,2
7,255,255
4000 REM END OF GAME
4010 CLS
4020 PRINT AT 0,10;P$(PLAYER)
4030 IF WIN=1 THEN PRINT AT 2,0;
 INK 4;"LOSES THE GAME BY GOING
OFF THE BOARD."
4040 IF WIN=2 THEN PRINT AT 2,0;
 INK 5;"WINS THE GAME IN ";MVES;
" MOVES"
4060 IF WIN=1 THEN LET PLAYER=PL
AYER+1: IF PLAYER>2 THEN LET PLA
YER=1
4070 LET S(PLAYER)=S(PLAYER)+1
4080 PRINT AT 8,0; INK 3;"GAMES
WON SO FAR"
4090 PRINT AT 10,1; INK 5;P$(1);
" ";S(1): INK 6;AT 12,1;P$(2);"
";S(2)
4100 PLOT 0,95: DRAW 120,0: DRAW
 0,-25: DRAW -120,0: DRAW 0,25:
PLOT 88,95: DRAW 0,-25
4110 PLOT 0,83: DRAW 120,0
4120 PRINT #0; FLASH 1;"  PRESS
<SPACE> TO PLAY AGAIN.  "
4130 IF INKEY$<>" " THEN GO TO 4
130
4140 PRINT #0;AT 1,0;"ARE THE PL
AYERS THE SAME ?.              "
4150 LET Z$=INKEY$
4160 IF Z$="Y" THEN LET START=ST
ART+1: IF START>2 THEN LET START
=1
4170 IF Z$="Y" THEN GO TO 50
4180 IF Z$="N" THEN RUN
4190 GO TO 4150
5000 REM MOVE CHECK
5010 BEEP .5,30
5020 GO TO 4990+A(AX,AY)*40
5030 IF X1<X THEN LET X1=X: LET
Y1=Y: LET AX=AX+1: LET X=X+2: GO
 TO 5150
5040 IF X1>X THEN LET X1=X: LET
Y1=Y: LET AX=AX-1: LET X=X-2: GO
 TO 5150
5050 IF Y1<Y THEN LET X1=X: LET
Y1=Y: LET AY=AY+1: LET Y=Y+2: GO
 TO 5150
5060 IF Y1>Y THEN LET X1=X: LET
Y1=Y: LET AY=AY-1: LET Y=Y-2: GO
 TO 5150
5070 IF X1<X THEN LET X1=X: LET
Y1=Y: LET AY=AY-1: LET Y=Y-2: GO
 TO 5150
5080 IF X1>X THEN LET X1=X: LET
Y1=Y: LET AY=AY+1: LET Y=Y+2: GO
 TO 5150
5090 IF Y1<Y THEN LET X1=X: LET
Y1=Y: LET AX=AX-1: LET X=X-2: GO
 TO 5150
5100 IF Y1>Y THEN LET X1=X: LET
Y1=Y: LET AX=AX+1: LET X=X+2: GO
 TO 5150
5110 IF X1<X THEN LET X1=X: LET
Y1=Y: LET AY=AY+1: LET Y=Y+2: GO
 TO 5150
5120 IF X1>X THEN LET X1=X: LET
Y1=Y: LET AY=AY-1: LET Y=Y-2: GO
 TO 5150
5130 IF Y1<Y THEN LET X1=X: LET
Y1=Y: LET AX=AX+1: LET X=X+2: GO
 TO 5150
5140 IF Y1>Y THEN LET X1=X: LET
Y1=Y: LET AX=AX-1: LET X=X-2: GO
 TO 5150
5150 IF X<1 OR X>16 OR Y<1 OR Y>
16 THEN LET WIN=1: BEEP 1,-25: G
O TO 4000
5160 IF X=15 AND Y=15 THEN LET W
IN=2: GO TO 4000
5170 IF A(AX,AY)<>0 THEN GO TO 5
020
5180 LET MVES=MVES+1: LET PLAYER
=PLAYER+1
5190 GO TO 160
6000 REM DRAW BOARD
6010 OVER 0: CLS : FOR A=7 TO 13
5 STEP 16: PLOT A,39: DRAW 0,128
: NEXT A
6020 FOR A=39 TO 168 STEP 16: PL
OT 7,A: DRAW 128,0: NEXT A
6030 PLOT 3,35: DRAW 137,0: DRAW
 0,137: DRAW -137,0: DRAW 0,-137
6040 PRINT AT 1,18;"X ";A$(1);"
Y ";B$(1);" Z ";C$(1): PRINT AT
2,20;A$(2);"   ";B$(2);"   ";C$(
2)
6050 FOR A=159 TO 239 STEP 40: P
LOT A,151: DRAW 16,0: DRAW 0,16:
 DRAW -16,0: DRAW 0,-16: NEXT A
6060 PRINT AT 4,18; INK 5;"YOUR
MOVE :-"
6070 PRINT AT 7,19; INK 6;"MOVES
 MADE SO";AT 8,22;"FAR = ";MVES
6120 PRINT AT 1,1; OVER 1;A$(1);
AT 2,1;A$(2);AT 15,15;A$(1);AT 1
6,15;A$(2)
6130 LET A=19: LET B=4: LET C=4:
 LET D=10: GO SUB 300
6140 RETURN
7000 REM INSTRUCTIONS
7010 CLS : LET C=4: GO SUB 3040
7020 PRINT AT 15,3; INK 5; FLASH
 1;"Do you want instructions ?":
7025 IF INKEY$="N" THEN GO TO 71
50
7026 IF INKEY$="Y" THEN GO TO 70
30
7027 GO TO 7025
7030 LET A=0: LET B=4: CLS : GO
SUB 3000: PRINT AT 3,4; INK 0;"■
■■■■■■■■■■■■■■■■■■■■"
7035 PRINT '" The idea of SQUIG
GLE is quite  simple. All you ha
ve to do is   complete a continu
ous line from the top left hand
corner of the board to the botto
m right hand  corner, or force y
our opponent  off the edge."
7040 PRINT '" There are three pi
eces which   may be placed they
are :-  "
7050 PRINT '"X ";A$(1);"  Y ";B$
(1);"  Z ";C$(1): PRINT "  ";A$(
2);"     ";B$(2);"     ";C$(2)
7060 PLOT 15,23: DRAW 16,0: DRAW
 0,16: DRAW -16,0: DRAW 0,-16
7070 PLOT 63,23: DRAW 16,0: DRAW
 0,16: DRAW -16,0: DRAW 0,-16
7080 PLOT 111,23: DRAW 16,0: DRA
W 0,16: DRAW -16,0: DRAW 0,-16
7090 PRINT #0; FLASH 1; INK 2; P
APER 5;"  Press any key to cont
inue.  "
7100 IF INKEY$="" THEN GO TO 710
0
7110 CLS : PRINT " As the first
piece will be     placed to the
right of the startsquare, placin
g piece 'Y' will  automatically
lose the game for you."
7120 PRINT '" When you play the
game all you have to do is tell
the computer which piece you wou
ld like to  place and the compu
ter will do  the rest."
7130 PRINT #0; FLASH 1; INK 2; P
APER 5;"      Press space to pla
y.  "
7140 IF INKEY$<>" " THEN GO TO 7
140
7150 INPUT "YOUR NAME PLEASE PLA
YER 1        ";P$(1)
7160 INPUT "YOUR NAME PLEASE PLA
YER 2        ";P$(2)
7170 FOR A=1 TO 2: IF LEN P$(A)>
10 THEN LET P$(A)=P$(A, TO 10)
7180 NEXT A: CLS : RETURN
8000 REM VARIABLES
8010 DIM A$(2,2): DIM B$(2,2): D
IM C$(2,2): DIM A(8,8): DIM S(2)
: DIM P$(2,10)
8020 LET A$(1)="⊥": LET A$(2)="
T"
8030 LET B$(1)="/": LET B$(2)="
/"
8040 LET C$(1)="\": LET C$(2)="
\"
8050 LET S(1)=0: LET S(2)=0
8070 LET START=1
8998 RETURN
9000 REM UDG'S
9010 RESTORE 9030: FOR A=USR "A"
 TO USR "L"+7
9020 READ B: POKE A,B: NEXT A
9030 DATA 0,1,1,1,1,1,1,255,0,12
8,128,128,128,128,128,254
9040 DATA 255,1,1,1,1,1,1,1,254,
128,128,128,128,128,128,128
9050 DATA 0,1,1,3,3,6,28,248,0,1
28,128,0,0,0,0,6
9060 DATA 224,0,0,0,0,1,1,1,30,5
6,96,192,192,128,128,128
9070 DATA 0,1,1,0,0,0,0,224,0,12
8,128,192,192,96,56,30
9080 DATA 248,28,6,3,3,1,1,1,6,0
,0,0,0,128,128,128
9090 RETURN
9997 STOP
9998 RANDOMIZE USR 15363: REM :
ERASE "SQUIGGLE"
9999 RANDOMIZE USR 15363: REM :
SAVE "SQUIGGLE" LINE 10
```

CHARACTER DESIGNER

◆RA Mason ● CBM-64
● Alton, Hampshire

This is a utility program to help in the design of a new character set.

It uses all eight sprites, an interrupt routine to give three character sets on the screen at once, several short machine-code routines, and allows for saving and loading of character sets.

There are three choices at the start of the program, to copy all the Commodore characters and then customise them, to start with a blank set, or to retain the set already in memory — the memory area used for the new characters is 12288 — 16384 or \$3000 – \$4000.

The section of the character set which may be re-designed is the alpha-numeric area of upper/lower case, a total of 128 characters.

As the character is designed the corresponding character on screen is changed. The green set is to select the symbol to be changed, the black set beneath is the new set. The program requires the use of a

(continued on next page)

File

(continued from previous page)

joystick in port two.

Once the new set has been saved to tape or disc it may be loaded into any future program by LOAD "name",device,1. As the new set is in the area normally used by Basic it must be protected by POKE52,48:POKE56,58. This will reduce the amount of memory available to the Basic user. To switch the Commodore set out and the new set in the following command is necessary: POKE53272,28 then select upper/lower case by CHR$(14) or pressing Commodore/Shift keys.

I advise saving the program after typing it in as the program relies heavily on pokes, and just one mistake might cause a crash if run. ●

Character designer.

```
1 REM [CHARACTER-SET DESIGNER BY R.A.MASON (1985)]
2 :
3 :
4 REM  [MACHINE CODE ROUTINES:
     ]
5 REM  [SYS49152($C000) = INTERRUPT
     ]
6 REM  [SYS49272($C078) = PLOT
     ]
7 REM  [SYS49301($C095) = ZERO SET-DATA   ]
8 REM  [SYS49394($C0AC) = MOVE COMMODORE SET ]
9 REM  [SYS49397($C0F5) = TURN INTERRUPT OFF ]
10 REM [SYS49430($C116) = INPUT
     ]
11 REM [SYS49451($C128) = SAVE
     ]
12 REM [SYS49472($C140) = LOAD
     ]
13 :
14 :
19 REM [SPRITE AND MACHINE CODE LOADER]
20 POKE52,46:POKE56,46
30 POKE53280,0:POKE53281,0
40 GOSUB900
50 PRINT:PRINT"PLEASE WAIT..."
60 GOSUB570
70 FORC=0TO7:POKE12288+8*(33+255)+C,0:NEXT
99 REM [MAIN PROGRAM]
100 GOSUB1000
110 GOSUB1100
120 GOSUB1200
130 ONAGOSUB1300,1700,1750,1900
140 IFKP=1THENKP=0:GOTO130
150 IFEN=1THENSYS49397:END
160 IFRS=1THENRS=0:CLR:GOTO100
170 GOSUB1205
180 GOTO130
499 REM [SPRITE DATA]
500 DATA252,0,0,252,0,0,252,0
501 DATA0,252,0,0,252,0,0,252
502 DATA0,0,252,0,0,252,0,0
503 DATA0,0,0,0,0,0,0,0
504 DATA0,0,0,0,0,0,0,0
505 DATA0,0,0,0,0,0,0,0
506 DATA0,0,0,0,0,0,0,0
507 DATA0,0,0,0,0,0,0,0
508 DATA255,0,0,126,0,0,60,0
509 DATA0,24,0,0,0,0,0,0
510 DATA0,0,0,0,0,0,0,0
511 DATA0,0,0,0,0,0,0,0
512 DATA0,0,0,0,0,0,0,0
513 DATA0,0,0,0,0,0,0,0
514 DATA0,0,0,0,0,0,0,0
515 DA:A0,0,0,0,0,0,0,0
516 DATA128,0,0,192,0,0,224,0
517 DATA0,240,0,0,240,0,0,224
518 DATA0,0,192,0,0,128,0,0
519 DATA0,0,0,0,0,0,0,0
520 DATA0,0,0,0,0,0,0,0
521 DATA0,0,0,0,0,0,0,0
522 DATA0,0,0,0,0,0,0,0
523 DATA0,0,0,0,0,0,0,0
524 DATA252,0,0,132,0,0,132,0
525 DATA0,132,0,0,132,0,0,252
526 DATA0,0,0,0,0,0,0,0
527 DATA0,0,0,0,0,0,0,0
528 DATA0,0,0,0,0,0,0,0
529 DATA0,0,0,0,0,0,0,0
530 DATA0,0,0,0,0,0,0,0
531 DATA0,0,0,0,0,0,0,0
532 DATA0,0,0,0,0,0,0,0
533 DATA0,0,0,0,0,0,0,0
534 DATA0,0,23,255,232,46,30,244
535 DATA46,252,244,46,62,244,46,254
536 DATA244,118,252,118,111,255,246,112
537 DATA15,206,111,255,246,96,0,6
538 DATA96,0,6,0,0,0,0,0
539 DATA0,0,0,0,0,0,0,24
540 DATA0,0,0,0,0,0,0,0
541 DATA0,0,0,0,0,0,0,0
542 DATA0,0,23,255,232,46,28,244
543 DATA/ ,251,116,46,62,244,46,251
544 DATA116,118,252,246,111,255,246,112
545 DATA112,14,111,255,246,96,0,6
546 DATA96,0,6,0,0,0,0,0
547 DATA0,0,0,0,0,0,0,24
548 DATA0,0,0,0,0,0,0,0
549 DATA0,0,0,0,0,0,0,0
550 DATA0,0,23,255,232,46,24,116
551 DATA46,251,244,46,56,116,46,255
552 DATA116,118,248,246,111,255,246,112
553 DATA15,206,111,255,246,96,0,6
554 DATA96,0,6,0,0,0,0,0
555 DATA0,0,0,0,0,0,0,24
556 DATA0,0,0,0,0,0,0,0
557 DATA0,0,0,0,0,0,0,0
558 DATA0,0,23,255,232,46,24,116
559 DATA46,255,116,46,62,244,46,253
560 DATA244,118,251,246,111,255,246,115
561 DATA131,206,111,255,246,111,255,246
562 DATA111,255,246,111,255,246,0,0
563 DATA0,0,0,0,0,0,0,24
564 DATA24330
570 FORC=0TO511:READD:POKE11776+C,D:T=T+D:NEXT
575 READD:IFD<>TTHENPRINT:PRINT"ERROR IN DATA (PART 1)":STOP
599 REM [MACHINE CODE DATA]
600 DATA169,127,141,13,220,169,32,141
601 DATA20,3,169,192,141,21,3,169
602 DATA170,141,18,208,169,27,141,17
603 DATA208,169,129,141,26,208,96,234
604 DATA169,1,141,25,208,173,18,208
605 DATA201,170,240,21,201,218,240,38
606 DATA201,255,240,47,173,13,220,41
607 DATA1,240,3,76,49,234,76,188
608 DATA254,169,13,141,32,208,141,33
609 DATA208,169,23,141,24,208,169,218
610 DATA141,18,208,208,223,234,169,30
611 DATA141,24,208,169,255,141,18,208
612 DATA208,218,234,169,0,141,32,208
613 DATA141,33,208,169,21,141,24,208
614 DATA169,170,141,18,208,208,189,234
615 DATA32,250,174,32,158,183,138,72
616 DATA32,253,174,32,158,183,138,72
617 DATA32,247,174,104,168,104,170,24
618 DATA32,240,255,96,234,169,0,168
619 DATA133,251,162,48,134,252,162,16
620 DATA145,251,200,208,251,230,252,202
621 DATA208,246,96,234,120,169,127,141
622 DATA13,220,173,14,220,41,254,141
623 DATA14,220,165,1,41,251,133,1
624 DATA169,0,168,133,251,133,253,162
625 DATA208,134,252,162,48,134,254,162
626 DATA16,177,251,145,253,200,208,249
627 DATA230,252,230,254,202,208,242,165
628 DATA1,9,4,133,1,173,14,220
629 DATA9,1,141,14,220,169,129,141
630 DATA13,220,88,96,234,169,127,141
631 DATA13,220,169,0,141,26,208,32
632 DATA21,253,169,129,141,13,220,169
633 DATA0,141,32,208,141,33,208,169
634 DATA21,141,24,208,96,234,160,0
635 DATA32,207,255,201,13,240,6,153
636 DATA0,194,200,208,243,152,141,16
637 DATA194,96,234,32,75,193,169,0
638 DATA133,251,169,48,133,252,169,251
639 DATA162,0,160,64,32,216,255,96
640 DATA32,75,193,169,0,170,168,32
641 DATA213,255,96,169,1,166,2,160
642 DATA1,32,186,255,173,16,194,162
643 DATA0,160,194,32,189,255,96,0
644 DATA72562
650 FORC=0TO351:READD:POKE49152+C,D:T=T+D:NEXT
655 READD:IFD<>TTHENPRINT:PRINT"ERROR IN DATA (PART 2)":STOP
899 REM [TITLE]
900 PRINTCHR$(147)CHR$(30)"CHARACTER DESIGNER":RETURN
999 REM [SET SELECTION SCREEN]
1000 SYS49152:POKE53269,0
1005 GOSUB900
1010 PRINT:PRINT"SELECT:"
1015 PRINT"COPY COMMODORE CHARACTERS - C"
1020 PRINT"ZERO CHARACTER DATA
  - Z"
1025 PRINT"RETAIN EXISTING SET
  - R"
1030 GETA$:IFA$<>""THEN1050
1035 FORC=0TO6:P1=1104+C:P2=PEEK(P1)
1040 IFP2>128THENPOKEP1,P2-128:NEXT:GOTO1030
1045 IFP2<128THENPOKEP1,P2+128:NEXT:GOTO1030
1050 IF(A$<>"C"ANDA$<>"Z"ANDA$<>"R")THEN1030
1055 IFA$="C"THENSYS49324
1060 IFA$="Z"THENSYS49301
1065 SYS49152
1070 Y1=88:X1=172:Y2=82:X2=178
1075 RETURN
1099 REM [COMMODORE AND DESIGN CHARACTERS]
1100 PRINTCHR$(30):C=32:X=16:Y=0
1105 FORFLAG=0TO1
1110 FORV=0TO3:FORH=0TO31:SYS49272(X+V,Y+H):PRINTCHR$(C);:C=C+1:NEXT:NEXT
1115 X=21:C=32:POKE646,0:NEXT
1120 PRINTCHR$(153)CHR$(19)
1125 RETURN
1199 REM [MODE SELECTION SCREEN]
1200 RE=0:FORC=0TO159:POKE1104+C,32:NEXT
1205 PRINTCHR$(151):SYS49272(2,1):FORC=0TO7:PRINTCHR$(175);:NEXT:PRINT
1210 FORX=0TO7:PRINTCHR$(170);:FORY=0TO7:PRINTCHR$(186);:NEXT:PRINT:NEXT
1211 PRINTCHR$(30)CHR$(32);:FORC=0TO7:PRINTCHR$(100);:NEXT:PRINT"ZERODATA"
1212 PRINTCHR$(32);:FORC=0TO7:PRINTCHR$(100);:NEXT:PRINT"COMPLETE"
1213 IFRE=1THENPRINTCHR$(151):RETURN
1215 SYS49272(3,25):PRINT"SELECT:"
1220 SYS49272(4,25):PRINT"DESIGN"
1225 SYS49272(5,25):PRINT"SAVE SET"
1230 SYS49272(6,25):PRINT"LOAD SET"
1235 SYS49272(7,25):PRINT"END"CHR$(151)
1240 C=0:FORCC=0TO14STEP2:SY(C)=53248+CC:SX(C)=53249+CC:C=C+1:NEXT
1245 POKE53287,11:POKE53288,11:POKE53289,11:POKE53290,11
1250 FORC=0TO3:POKE2040+C,188+C:NEXT
1255 Y=40:FORC=0TO3:POKESY(C),Y:NEXT
1260 POKESX(0),72:POKESX(1),82:POKESX(2),92:POKESX(3),102
1265 POKE53264,15:POKE53269,15
1270 GETA$:IFA$<>""THEN1275
1272 FORC=0TO6:P1=1169+C:P2=PEEK(P1)
1273 IFP2>128THENPOKEP1,P2-128:NEXT:GOTO1270
1274 IFP2<128THENPOKEP1,P2+128:NEXT:GOTO1270
1275 A=ASC(A$):IF(A<133ORA>136)THEN1270
1280 A=A-132
1290 RETURN
1299 REM [DESIGN SCREEN]
1300 SYS49272(3,25):FORC=0TO6:PRINTCHR$(32);:NEXT
1305 POKE53287,13
1315 POKE53291,0:POKE53292,0:POKE53293,0
1320 POKESX(4),X1:POKESY(4),Y1:POKESX(5),X2:POKESY(5),Y2
1321 POKESX(6),X2+40:POKESY(6),Y2
1325 POKESX(6),X2+40:POKESY(6),Y2
1330 POKE2044,185:POKE2045,186:POKE2046,186
1335 POKE53269,127
1340 GOSUB2000:IFKP=1THENRETURN
1345 IF(J$="U"ANDVP>0)THENVP=VP-1:X2=X2-8:GOTO1370
1350 IF(J$="D"ANDVP<3)THENVP=VP+1:X2=X2+8:GOTO1370
1355 IF(J$="L"ANDHP>0)THENHP=HP-1:Y1=Y1-8:GOTO1370
1360 IF(J$="R"ANDHP<23)THENHP=HP+1:Y1=Y1+8:GOTO1370
1365 IFJ$="F"THEN1395
1370 IFY1>255THENY=Y1-255:POKE53264,31:GOTO1380
1375 IFY1<255THENY=Y1:POKE53264,15
1380 POKESY(4),Y:POKESX(5),X2:POKESX(6),X2+40
1385 FORT=1TO30:NEXT
1390 GOTO1340
1395 POKE53291,5:POKE53292,5:POKE53293,5
1400 PX=3:PY=1
1405 AS=32*VP*24+HP
1410 SD=INT(AS/32)
1415 IFSD=1THENSD=AS:GOTO1430
1420 IFSD=2THENSD=AS-64:GOTO1430
1425 IFSD=3THENSD=AS-32:GOTO1430
1430 P=14336+8*SD
1435 FORL=0TO7
1440 BI=128
1445 FORR=0TO7
1450 IF(PEEK(P+L)ANDBI)=BITHENSYS49272(PX+L,PY+R):PRINT"(RVS) "
1455 BI=BI/2
1460 NEXT:NEXT
1470 SX=74:SY=32:LI=0:RO=0
1475 LI=0:RO=0
1480 B=128
1485 FORC=0TO7
1490 BI(C)=B:B=B/2
1495 NEXT
1500 POKE2047,187
1505 POKE53294,1
1510 POKESX(7),SX:POKESY(7),SY
1515 POKE53269,255
1520 GOSUB2000
1525 IFKP=1THENRETURN
1530 IF(J$="U"ANDLI>0)THENLI=LI-1:SX=SX-8
1535 IF(J$="D"ANDLI<9)THENLI=LI+1:SX=SX+8
1540 IF(J$="L"ANDRO>0)THENRO=RO-1:SY=SY-8
1545 IF(J$="R"ANDRO<7)THENRO=RO+1:SY=SY+8
1550 POKESX(7),SX:POKESY(7),SY
1555 IFJ$<>"F"THEN1520
1560 IFLI=0THENPOKE53269,127:FORC=0TO7:POKEP+C,0:NEXT:RE=1:GOSUB1205:GOTO1500
1565 IFLI=9THENRE=1:GOSUB1205:GOTO1300
1566 IFLI=9THENRE=1:GOSUB1205:GOTO1300
1570 IF(PEEK(P+LI)ANDBI(RO))=BI(RO)THEN1585
1575 POKEP+LI,(PEEK(P+LI)+BI(RO))
1580 SYS49272(PX+LI,PY+RO):PRINT"(RVS) ":GOTO1600
1585 POKEP+LI,(PEEK(P+LI)-BI(RO))
1590 SYS49272(PX+LI,PY+RO):PRINT"(SH @)":GOTO1600
1600 FORT=1TO150:NEXT:GOTO1520
1699 REM [SAVE SCREEN]
1700 POKE53269,0:SYS49397
1705 GOSUB900
1710 PRINT:PRINT"SAVE ROUTINE...":PRINT
1715 GOSUB1800:IFA$="A"THEN1790
1720 SYS49451:IFST=0THENGOTO1790
1725 GOSUB1860
1730 IFA$="A"THENGOTO1790
1735 GOTO1700
1749 REM [LOAD SCREEN]
1750 POKE53269,0:SYS49397
1755 GOSUB900
1760 PRINT:PRINT"LOAD ROUTINE...":PRINT
1765 GOSUB1800:IFA$="A"THEN1790
1770 SYS49472:IFST=64THENGOTO1790
1775 GOSUB1860
1780 IFA$="A"THENGOTO1790
1785 GOTO1750
1790 RE=0:KP=0:RS=1:RETURN
1799 REM [MAIN I/O ROUTINE]
1800 PRINT"PRESS 1 - CASSETTE"
1805 PRINT"      8 - DISK"
1810 PRINT"      A - ABORT"
1815 GETA$:IF(A$<>"1"ANDA$<>"8"ANDA$<>"A")THEN1815
1820 IFA$="A"THENRETURN
1825 POKE2,VAL(A$)
1830 PRINT:PRINT"ENTER CHARACTER SET NAME: ":SYS49430
1835 IFPEEK(49680)>16THENPRINT:PRINT"NAME TOO LONG...":FORT=1TO500:NEXT:GOTO1830
1840 PRINT:PRINT"PREPARE DEVICE..."
1845 PRINT"THEN PRESS R"
1850 GETA$:IFA$<>"R"THEN1850
1855 RETURN
1860 PRINT:PRINT"DEVICE ERROR!!!"
1865 IFPEEK(2)=1THENGOTO1880
1870 OPEN1,8,15:INPUT#1,A$,B$,C$,D$:PRINT#1,"I":CLOSE1
1875 PRINTA$;" ";B$
1880 PRINT"PRESS A - ABORT"
1885 PRINT"      R - RE-TRY"
1890 GETA$:IF(A$<>"A"ANDA$<>"R")THEN1890LIST1700-1790
1895 RETURN
1899 REM [END ROUTINE]
1900 FORC=0TO3:POKE53287,11:NEXT:SC=2:POKE53290,SC
1905 FORC=0TO50
1910 GETA$:IFA$<>""THENC=50
1915 NEXT
1920 IFA$=CHR$(136)THENPOKE808,237:POKE53269,0:PRINTCHR$(147):EN=1:RETURN
1925 IFA$<>""THENEN=0:RE=0:RETURN
1930 IFSC=11THENSC=2:GOTO1940
1935 SC=11
1940 POKE53290,SC:GOTO1905
1999 REM [JOYSTICK ROUTINE]
2000 J=PEEK(56320)
2005 FR=JAND16
2010 J=15-(JAND15)
2015 IFFR<>16THENJ$="F":GOTO2050
2020 IFJ=0THENGETA$:IFA$<>""THENGOTO2055
2025 IFJ=1THENJ$="U":GOTO2050
2030 IFJ=2THENJ$="D":GOTO2050
2035 IFJ=4THENJ$="L":GOTO2050
2040 IFJ=8THENJ$="R":GOTO2050
2045 GOTO2000
2050 RETURN
2055 A=ASC(A$)-132:IF(A>0ANDA<5)THENKP=1:GOTO2050
2060 GOTO2000

READY.
```

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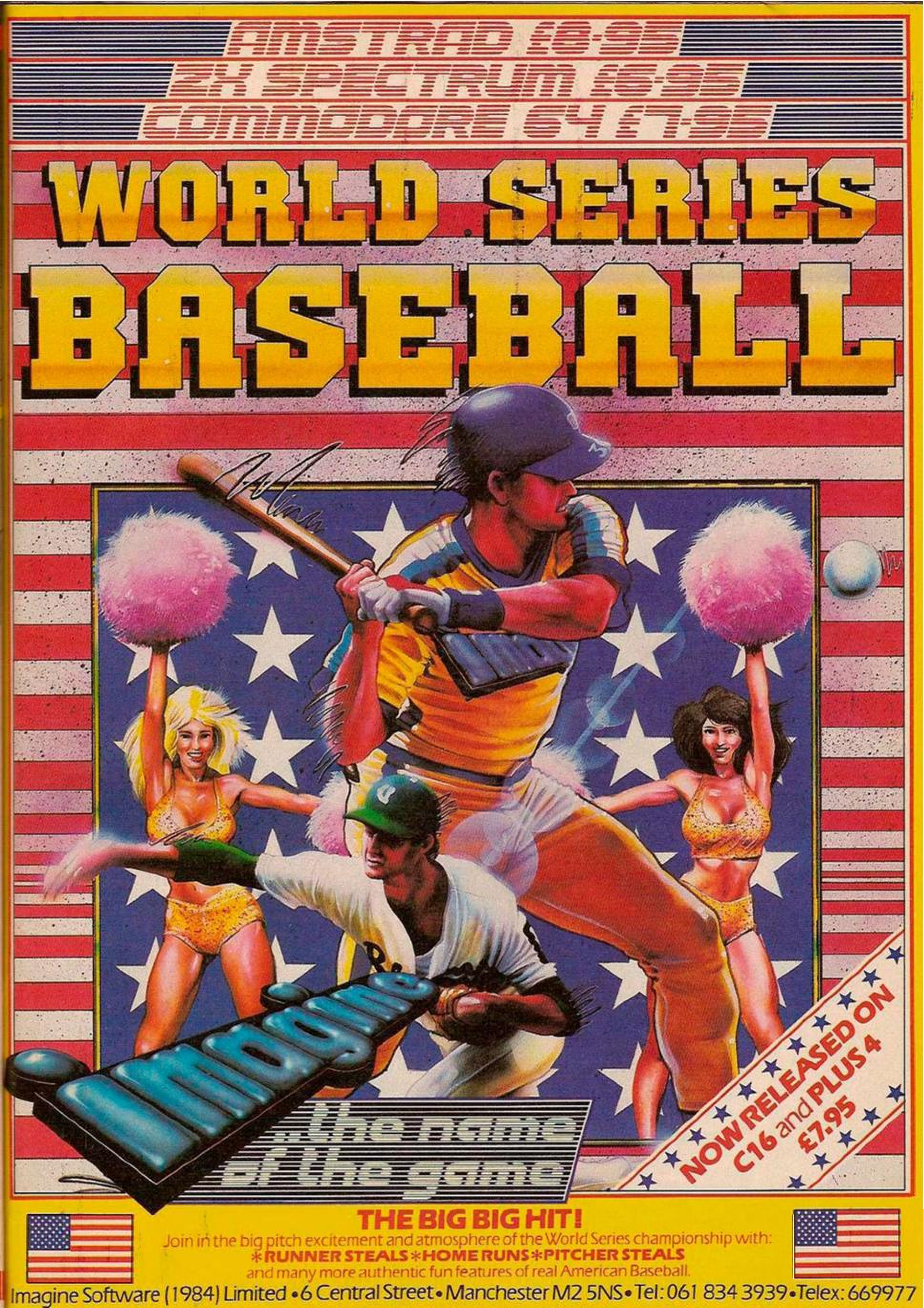
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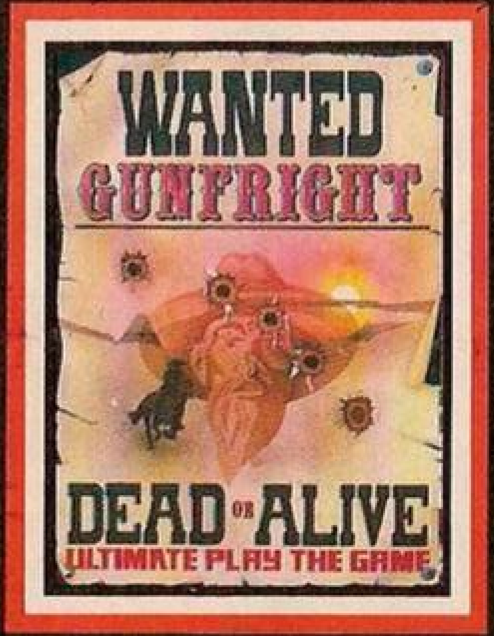

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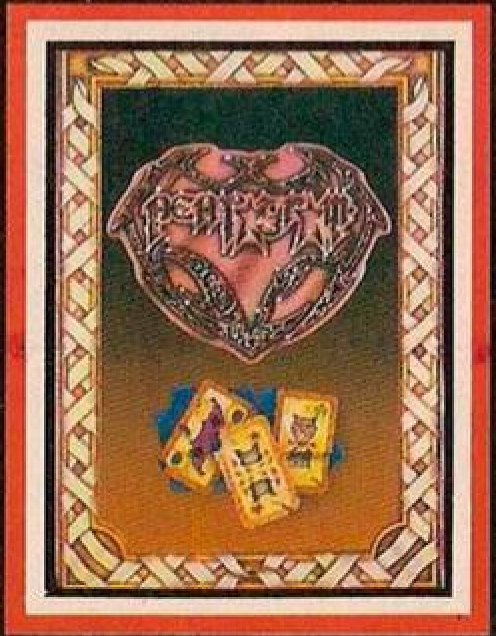
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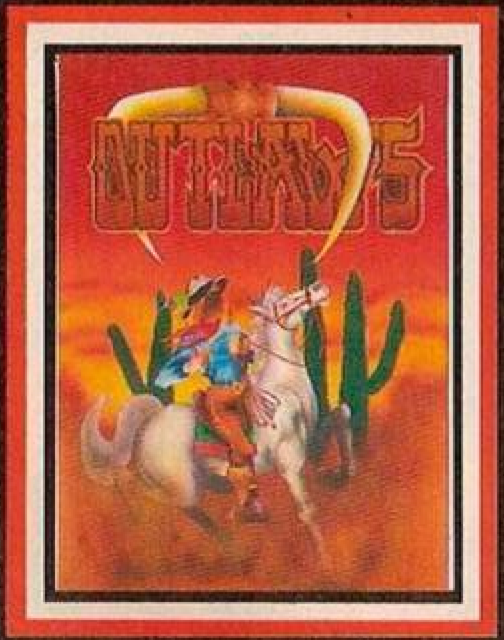
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COMMODORE 64



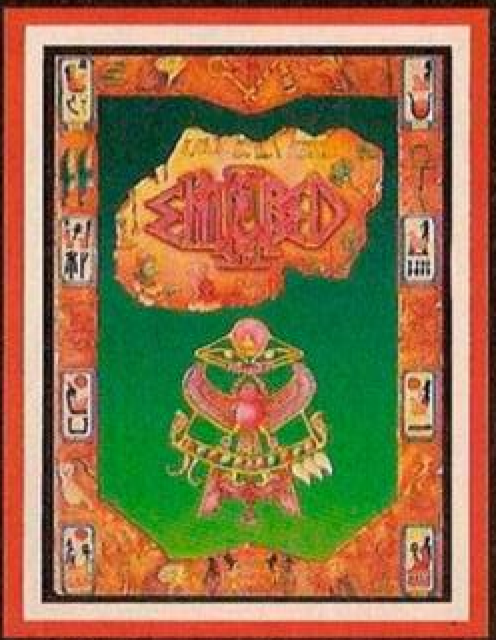
COMMODORE 64



COMMODORE 64



COMMODORE 64



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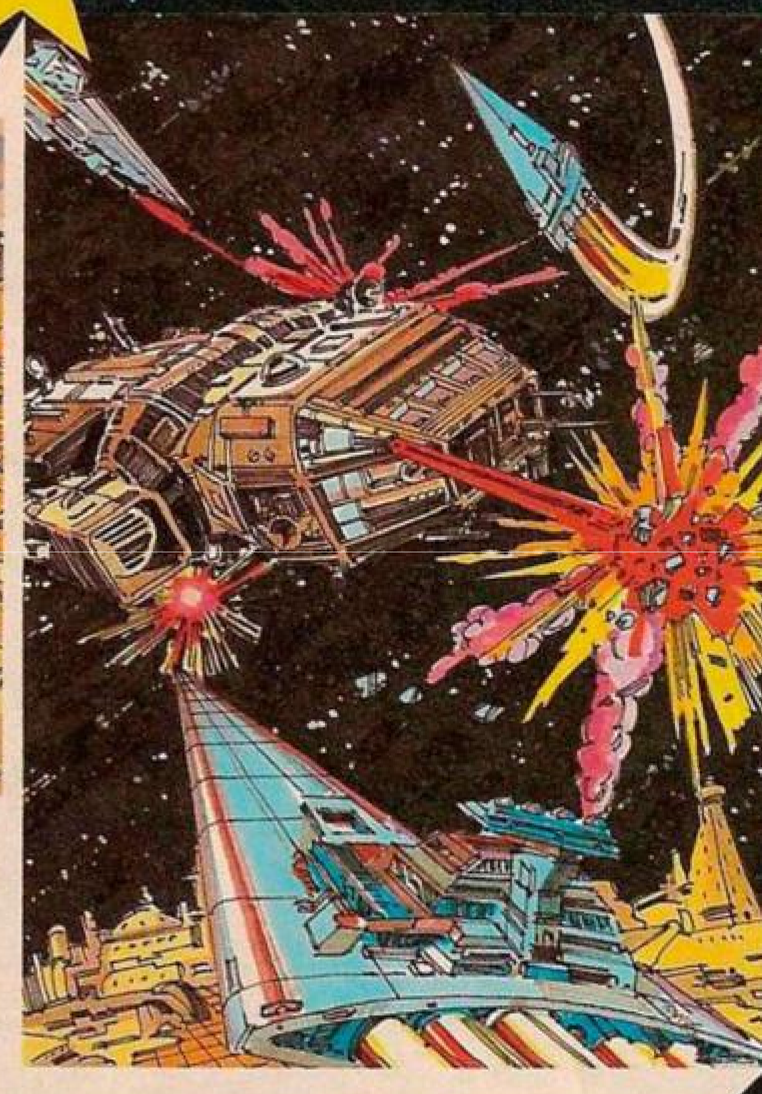


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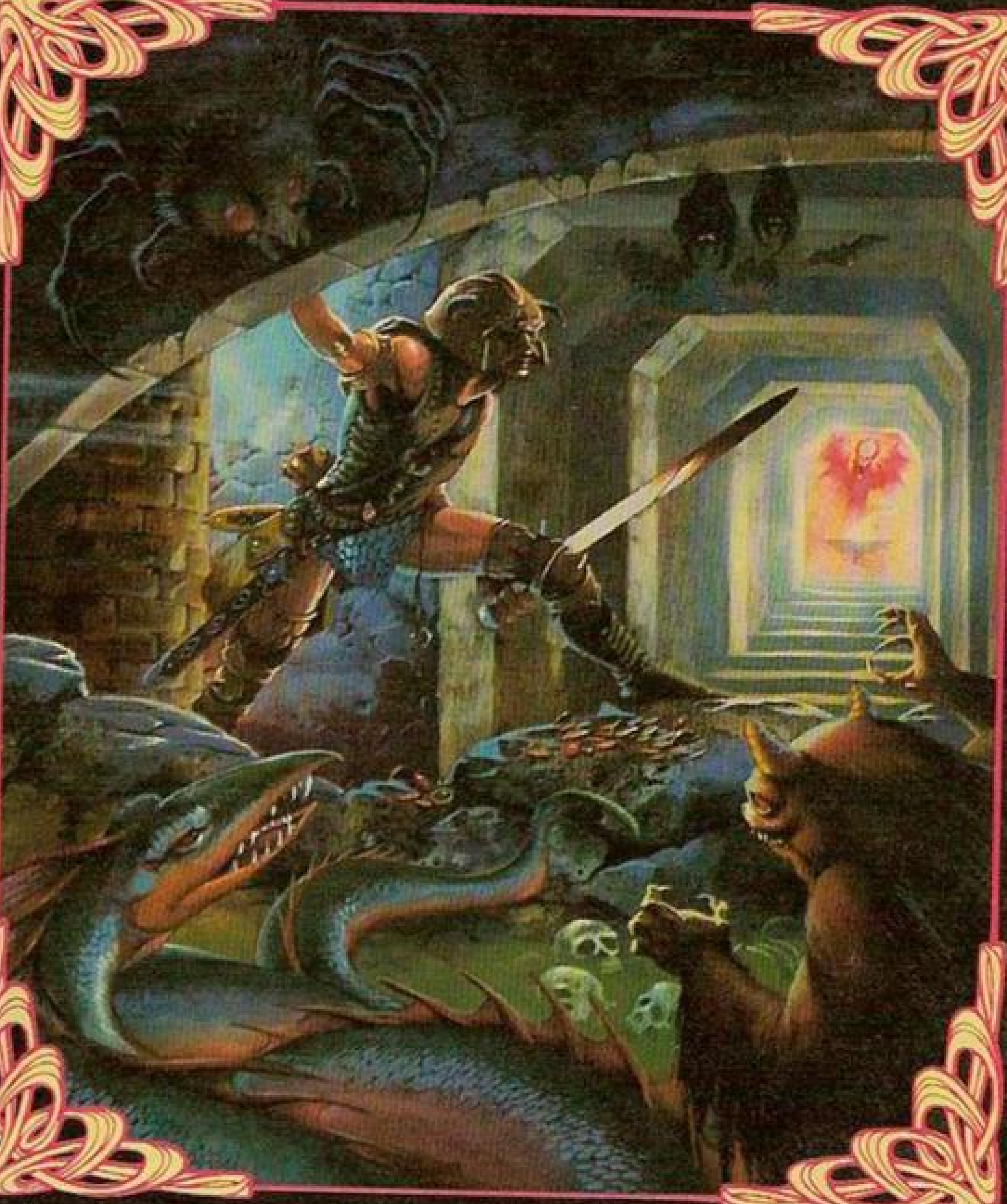
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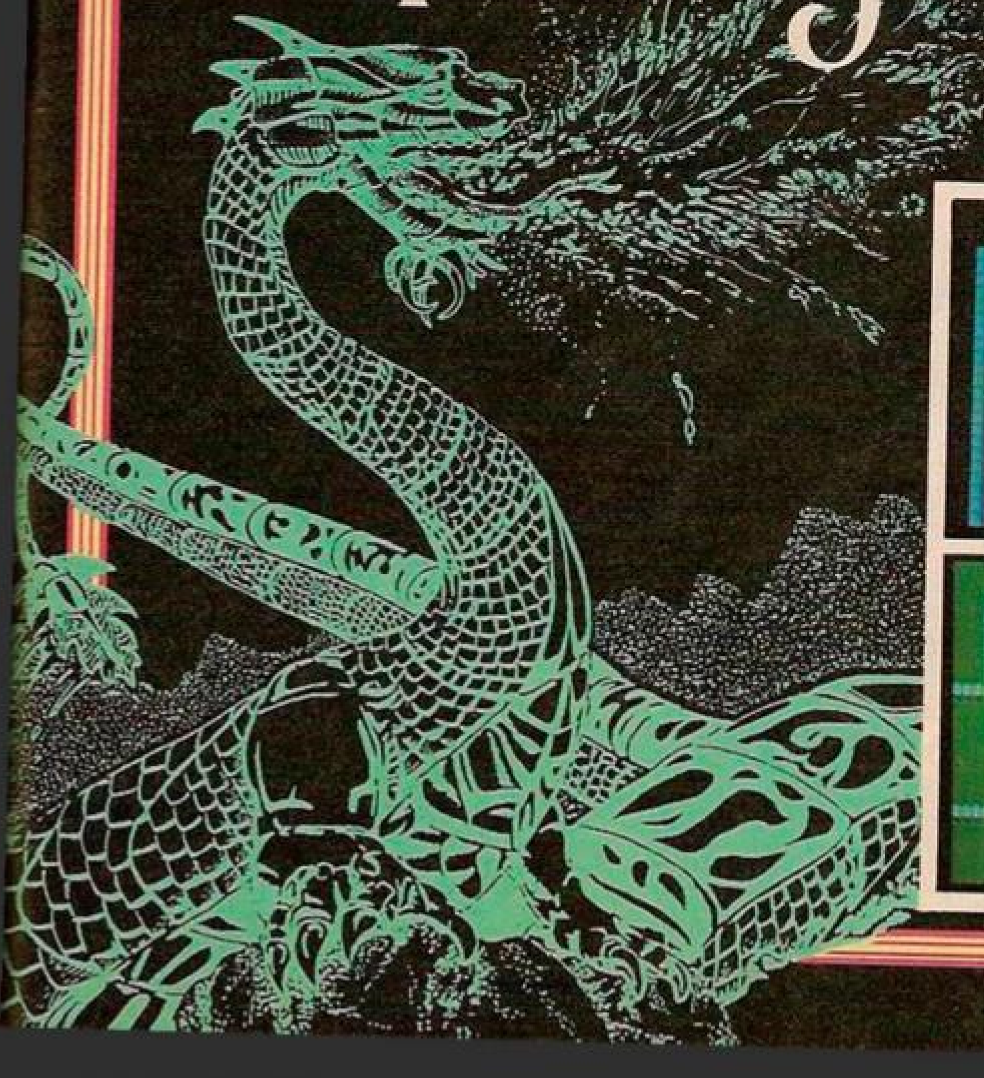


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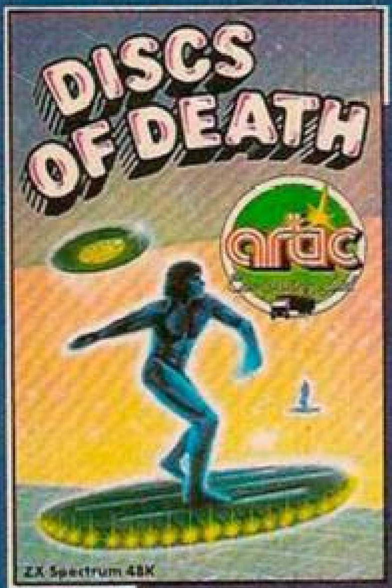
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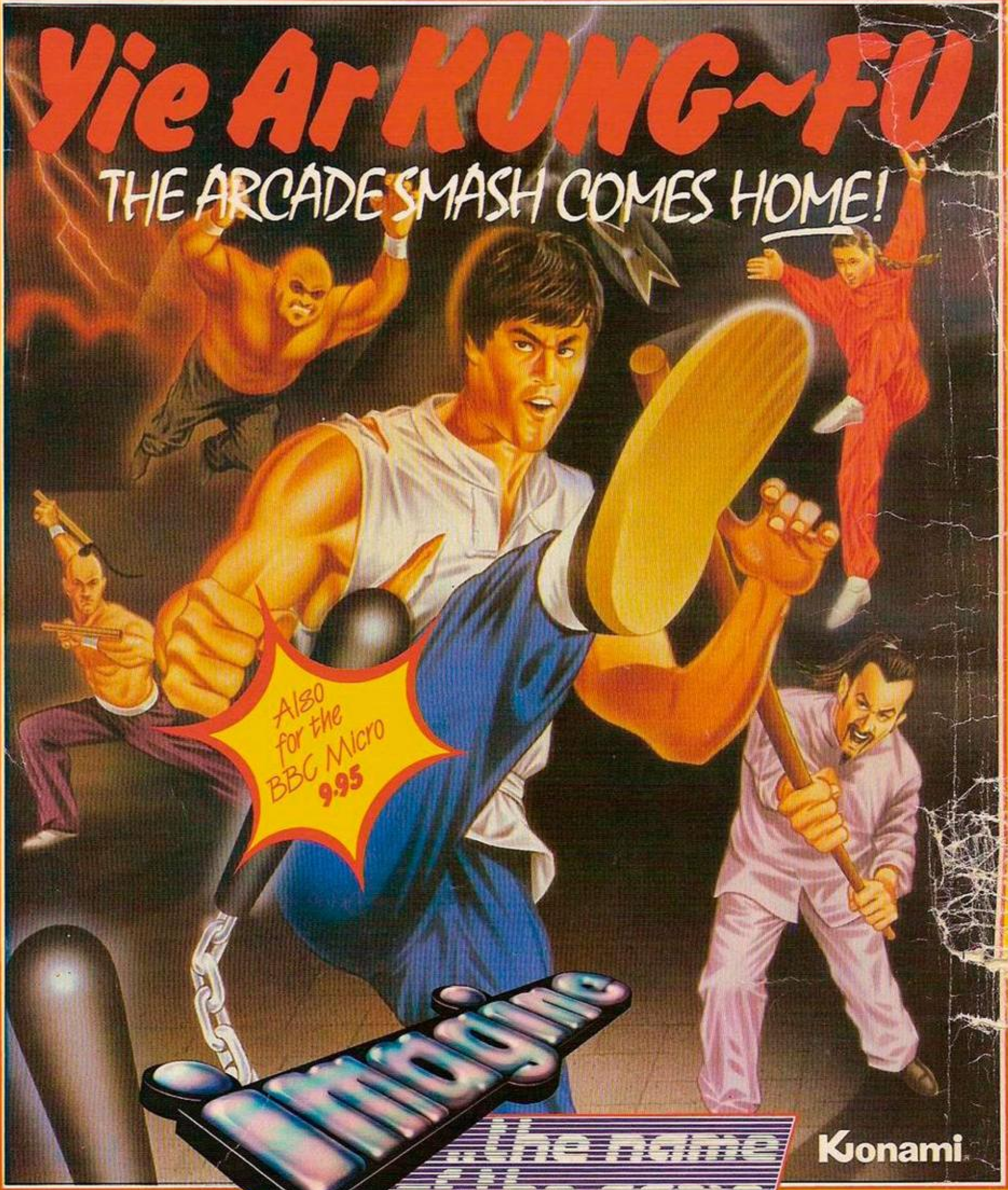
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